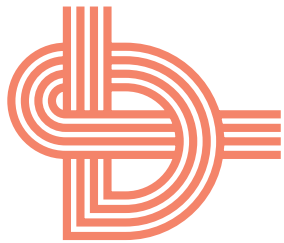
User's Guide

Getting Started with Datataker®

An introductory guide to…

- data acquisition
- data logging
- your Datataker
- DeTerminal software



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About this User's Guide

Welcome to "Getting Started with Datataker"!
This guide uses step-by-step instructions, simple explanations and simple examples to introduce you to — and give you confidence with — your Datataker.

If You Never Read Manuals...
Not this time.

There's no excuse.

This User's Guide is one manual you must read.

Investment
It won't take you long and, just like any good investment, the time you spend working through the information provided here will be repaid to you many times over as you use your Datataker.

Who It's For
This guide is primarily designed for ***new*** Datataker users (and inexperienced users of IBM® and compatible computers). If you work through all the steps in this manual *in the order in which they're presented*, you can be confident you'll learn enough about data acquisition and logging, your Datataker, and the software you use to communicate with it to satisfy your needs for a very long time.

If you're a semi-experienced Datataker and IBM user, you can skim through this guide noting only the major instruction steps. These are designated by a grey arrowhead icon as shown in the example immediately below. Instructions tagged in this way form a quick guide to prompt experienced users, as well as being a summary of the a, b, c,… sub-steps which follow (for new users).

This is an example of a major instruction step. Instructions tagged like this summarise what follows, and experienced users may need to read only these.

a) This is an example of an instruction sub-step. We recommend that inexperienced users read and carry out *every one of these*.

If you're an experienced Datataker and IBM user in a hurry, you can go directly to the appendix "For Experts Only". This is a quick-start summary for those who are already comfortable with data acquisition and logging concepts, and IBM-style computers.

Apple® Macintosh® users can easily work through this guide too. Read chapter 1, then as you work through chapter 2, be sure you refer to "Alternative Computers and Software" in the Extras following the section "Checklist".

Datataker Models
Although the instructions in this guide focus on Datataker models from the DT50 upwards, users of other Datataker models and products will still benefit from much of the information in this booklet (the use of DeTerminal communications software, for example).

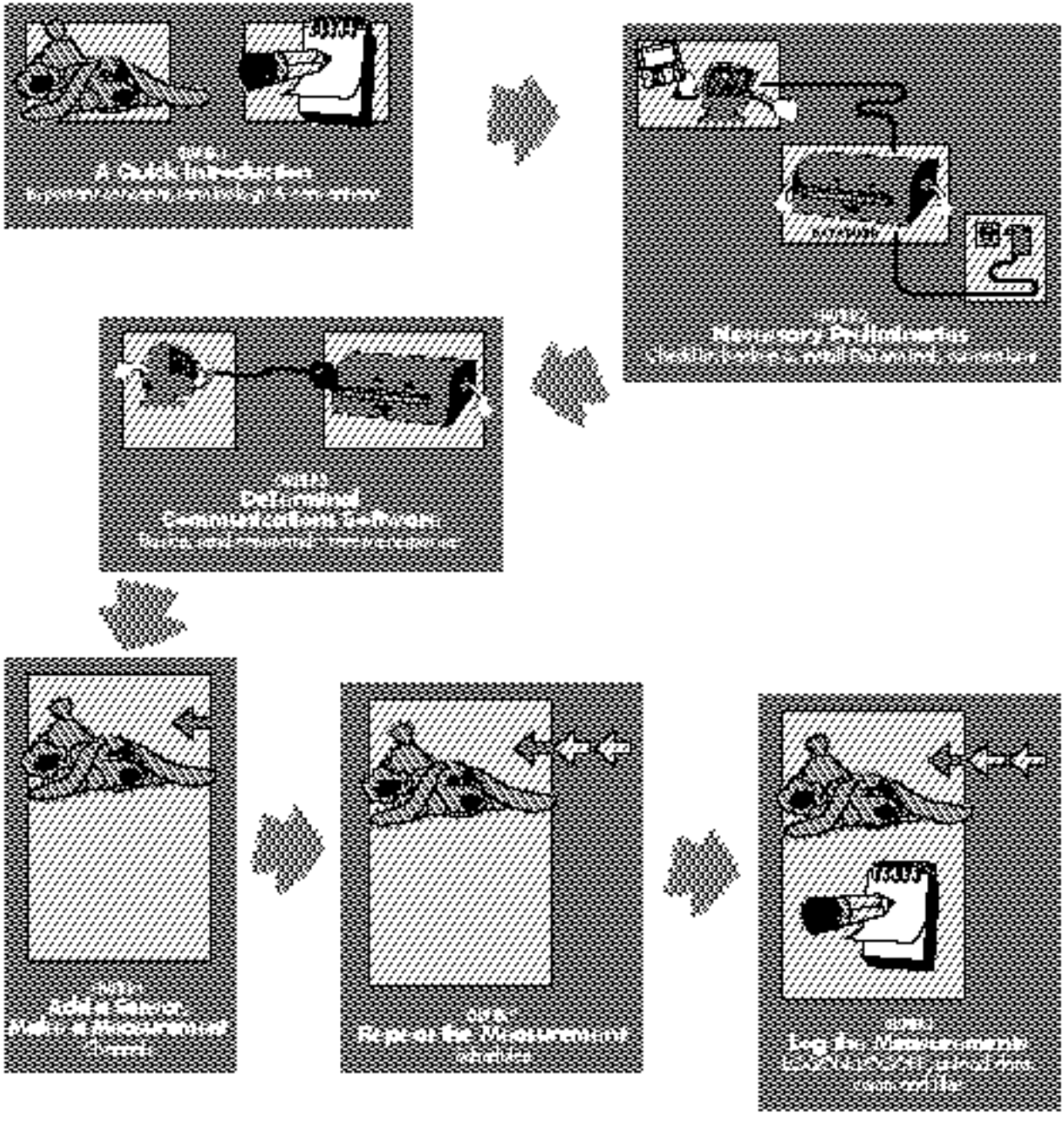
Extras

All readers will benefit from the "Extras" included with many of the topics. This is additional information intended to supplement each topic. You don't need to read the Extras to be able to work through this guide, although we do recommend you read them at some time because they contain valuable background information which will enhance your "big picture" of data acquisition and data logging.

More Information
Your Datataker is capable of extremely sophisticated data acquisition and logging. So if you want more information than this guide provides, refer to the "Datataker Manual" supplied with each new Datataker, or the "Reference Manual for the Datataker Data Loggers" available separately.

What Now?
Go to the next page, "Contents", for a bird's-eye-view of what's in store, then begin working through the step-by-step instructions starting with chapter 1 "A Quick Introduction to Your Datataker" on page 1.

(Remember, if you're *experienced* with data logging and IBM computers and you need to begin data logging quickly, you can go straight to the appendix "For Experts Only".)



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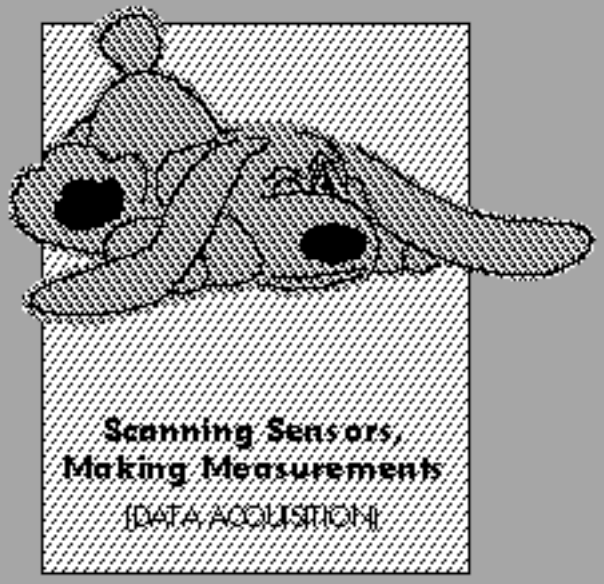
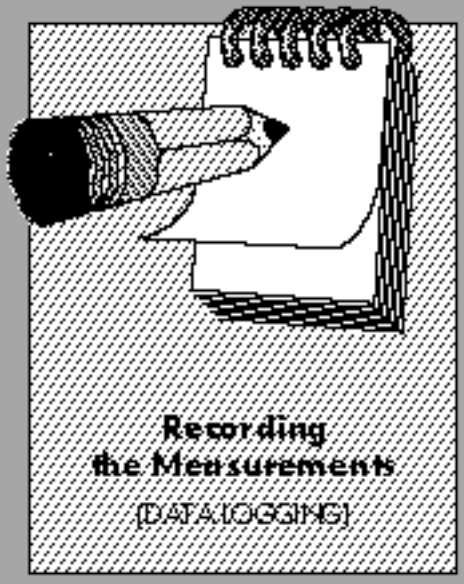


Scanning Sensors,
Making Measurements
(DATA ACQUISITION)



Recording
the Measurements
(DATA LOGGING)

DATATAKER

performs these functions, and more.

Chapter 1

A Quick Introduction

You really can't avoid it — there's just no way you can afford to shortcut this chapter.

It's quick to read, and it will make you comfortable with some fundamental Datataker data acquisition and logging concepts, terminology and conventions.

So read on…

1-1 Important Concepts

Your first job as you work through this User's Guide is to familiarise yourself with the following concepts:

1-1.1 Data Acquisition and Data Logging

Data acquisition and data logging are not the same.

Traditionally, data **acquisition** has been defined as the regular *collection* of data — scanning sensors, making instantaneous measurements, then feeding these to a recorder or computer.

Data **logging** has two possible definitions:

- It's considered by some to be simply *making a permanent record* of data that has been collected: printing or plotting it, writing it on a sheet of paper, or storing it on a computer's hard disk or in electronic memory.
- Others perceive data logging as the total operation of collecting data *and* making a permanent record of it — they see data acquisition as a subset of data logging.

Now, with Datataker, any distinction between these two terms has become even more blurred because the Datataker combines acquisition, logging, and more in a single instrument about the size of a house brick. It scans sensors and transducers, takes measurements, processes the data by performing conversions and calculations, records and/or displays the data, and raises alarms — all according to schedules which you define.

The Datataker View of Acquisition and Logging: Two Separate Functions

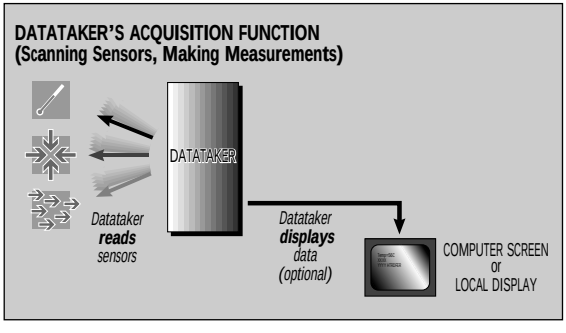
When using your Datataker, it's important that you treat acquisition and logging as *two separate functions*.

You'll see this clearly as you work through the chapters that follow. But for now, just keep in mind that the Datataker's first job is to scan the sensors connected to it and make measurements (acquire data). And then, if you want the measurements to be

stored by the Datataker, you must command it to log the measurements — logging is a separate, additional function of the Datataker. Here's the concept again in more detail:

Datataker's Acquisition Function

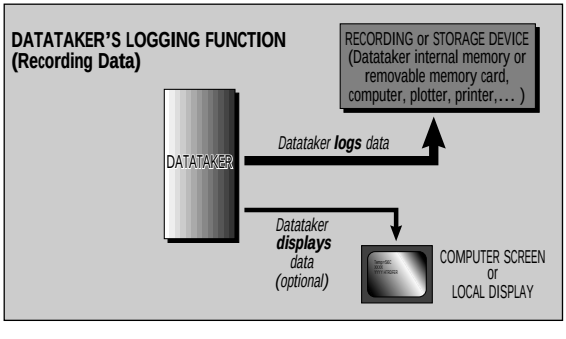
One of the Datataker's two basic functions is to "read" ("sample", "scan" or "measure") sensors and present the values to you on a computer screen or on the Datataker's inbuilt display (if it has one). Although these readings can be used, say, to trigger an alarm, they are temporary: *the Datataker has not recorded, stored or remembered them anywhere* — that is, the data has not been "logged" by the Datataker.



Datataker's Logging Function

To "log" ("record", "store" or "remember") data, you must issue the **Logon** command (explained later) to the Datataker after you've commanded it to acquire data.

Logging is a separate and distinct operation.


DATATAKER'S LOGGING FUNCTION
(Recording Data)
RECORDING or STORAGE DEVICE
(Datataker internal memory or removable memory card, computer, plotter, printer,…)
DATATAKER
Datataker logs data
Datataker displays data (optional)
COMPUTER SCREEN or LOCAL DISPLAY

1-1.2 The Datataker

Basically, the Datataker is an instrument for intelligently acquiring data from sensors connected to it, recording (logging) the data for later reference and/or analysis, and raising alarms.

Tasks

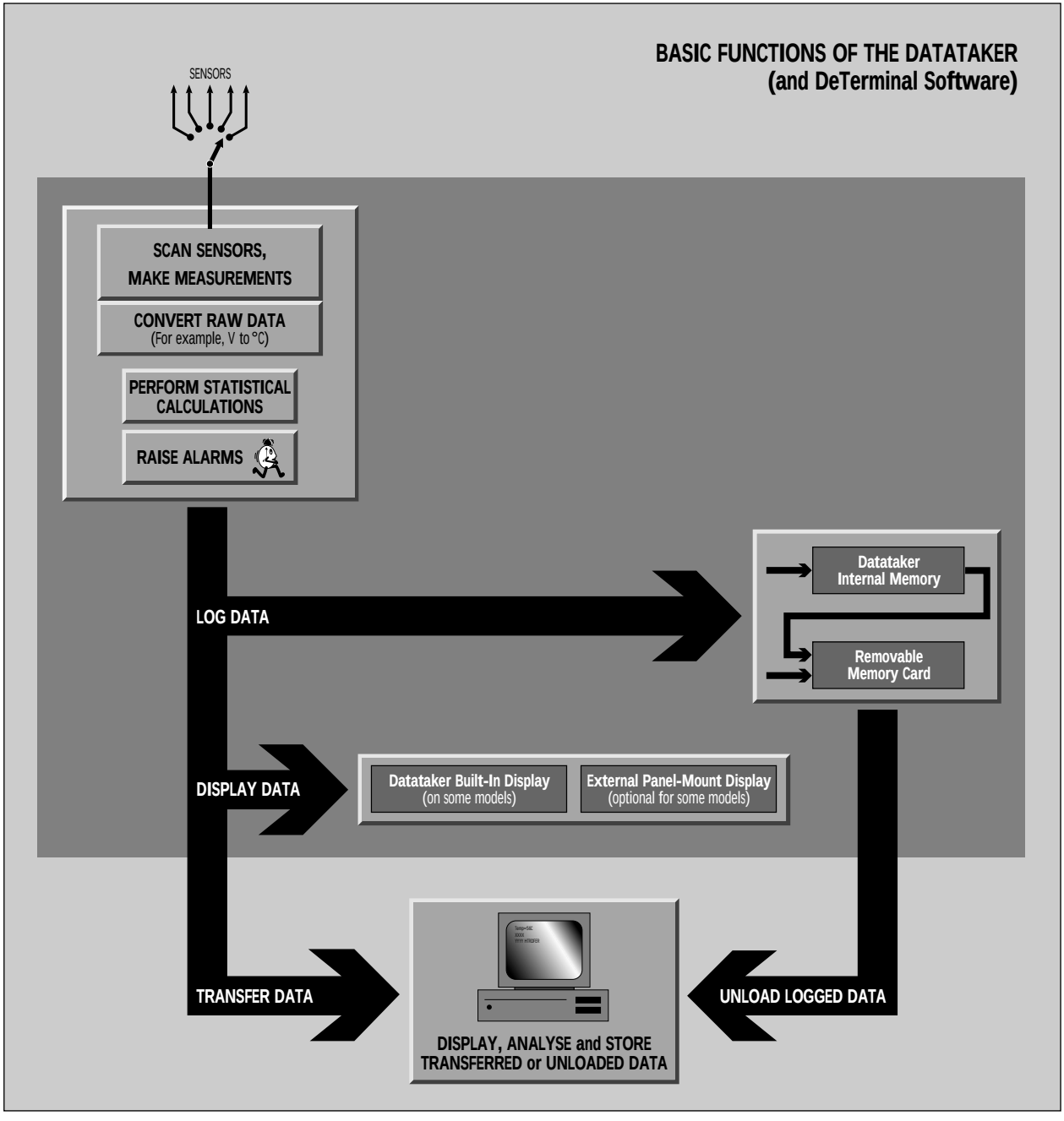
More specifically, your Datataker can perform any or all of the following tasks:

- acquire data (scan sensors, make instantaneous measurements and forward them to a computer);
- log data (store measurements in its own internal memory and/or its removable memory card);
- convert measurements according to your requirements (voltages to ºC or ºF, for example);
- carry out calculations on the measurements (average, standard deviation, maximum, minimum,…);
- log the converted measurements and the results of calculations to its internal memory and/or a removable memory card, or transfer them to a computer;
- display all of this on a computer screen, or locally (on the logger's inbuilt display or panel-mount display, if it has these);
- return data directly to a computer in real time (that is, as each measurement is made) as well as, or instead of, logging it;
- raise alarms when data is outside specified ranges. Alarms can trigger outside events (turn on a warning light or siren, for example), or make the Datataker carry out additional tasks (scan more frequently, stop logging, or scan and log additional sensors, for example).

These are summarised in the adjacent figure "Basic Functions of the Datataker".

Instructions

Being microprocessor-based, you send instructions ("commands") to the Datataker (from a computer terminal) telling it which sensors to read, when and how often to read them, how to interpret the readings, and what to do with the data. Then you let the Datataker do the work.


BASIC FUNCTIONS OF THE DATATAKER
(and DeTerminal Software)
SENSORS
SCAN SENSORS,
MAKE MEASUREMENTS
CONVERT RAW DATA
(For example, V to °C)
PERFORM STATISTICAL
CALCULATIONS
RAISE ALARMS
LOG DATA
Datataker
Internal Memory
Removable
Memory Card
DISPLAY DATA
Datataker Built-In Display
(on some models)
External Panel-Mount Display
(optional for some models)
TRANSFER DATA
UNLOAD LOGGED DATA
DISPLAY, ANALYSE and STORE
TRANSFERRED or UNLOADED DATA

Stand-Alone

Once you've set the Datataker running you can disconnect the computer if you wish — the Datataker will continue to operate as programmed because the software which controls the logger is inside the logger itself. This is called "stand-alone" operation.

Sensors and Signals

Using a Datataker you can monitor, record and raise alarms for readings from many types of sensors and transducers — temperature (thermocouples, thermistors, RTDs and solid-state sensors), pressure, flow, strain, digital state (high or low, off or on), count, frequency, period, voltage, current, resistance and so forth.

COMMON SENSORS:

- thermocouples
- thermistors
- RTDs (Resistance Temperature Detectors
- solid-state temperature sensors
- pressure sensors
- flow sensors
- load cells (strain gauges)

OUTPUTS:

- voltage
- current
- resistance
- counts (pulses)
- frequency
- digital state (on/off, high/low)

You can connect a variety of sensors to one Datataker and have them scanned whenever you choose. For example, you could connect two thermocouples, three variable resistances and four load cells to a Datataker and have them all scanned at the same time, or have various combinations of them scanned at different times.

Meaningful Quantities

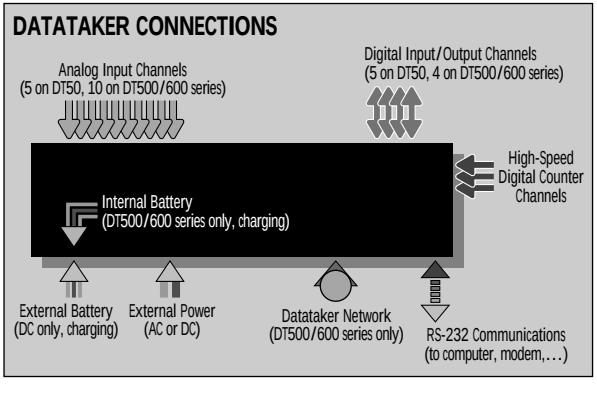
Whatever the sensor, its raw output will be either voltage, current, resistance, counts, frequency or digital state. For example, the output from a thermocouple is a voltage which varies according to the temperature being measured — the thermocouple's raw output is volts (under 100 millivolts, actually), *not* degrees Centigrade or Fahrenheit.

Once measured, the raw output must be converted to a temperature value. Depending on the type of sensor, this conversion involves "linearisation" and possibly "compensation", terms which are beyond the scope of this guide. Just be aware that raw measurements usually have to be converted before they become the meaningful quantities that are useful to you. One of the features of the Datataker is that it performs these conversions for you — automatically. All you have to do is tell the Datataker what ***type*** the sensor is (a T-type thermocouple, for example) and the microprocessor inside the logger performs the appropriate linearisation and compensation, turning the raw sensor output (millivolts, for example) into a meaningful quantity (like degrees Centigrade).

The Datataker also has facilities that allow the user to define linearisation characteristics for, say, an unusual sensor (one that is not directly supported by the Datataker), or to carry out statistical calculations.

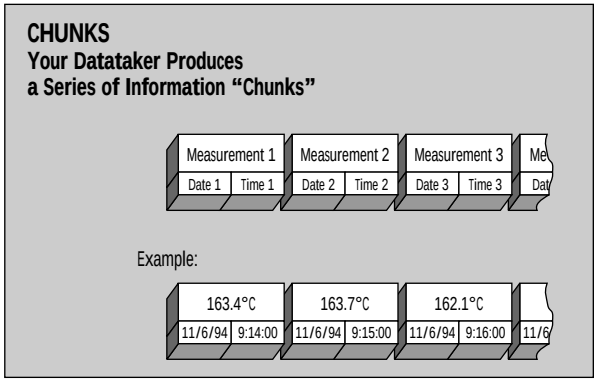
Connections — the Big Picture

The figure below gives you an overview of the connections provided on your Datataker.



Time- and Date-Stamping

You'll often want to know the time and date each measurement was made, so the Datataker automatically keeps this information along with the measurements. Thus every reading from every sensor can be "time- and date-stamped".



See "The Real Story — Time and Date" in the Extras below for additional information.

Examples

Here are some of the things you can command the Datataker to do:

- read sensors at time intervals that you set;
- read particular sensors, or stop reading them, when certain events or conditions occur;
- adjust the sensor reading rate so that readings are taken more frequently during conditions of greater interest;
- mathematically combine and manipulate sensor readings;
- apply statistical procedures to reduce the number of readings that need be stored;
- use different formats to report information (for example, to suit a computer program or a human operator);
- store sensor readings in the Datataker's internal memory;
- store and transport sensor readings in a credit-card-sized removable memory card;
- transmit sensor readings back to a mainframe, desktop or portable computer by direct connection, telephone modem, radio modem, or via a satellite terminal.
- control equipment external to the Datataker.

Here are some typical ways you can operate the Datataker:

- connected permanently to a computer, transferring data to the computer continuously or periodically;
- connected temporarily to a portable computer for transferring data or programming the Datataker;
- periodically transferring data to a distant computer via a pair of modems (the data transfer can be initiated by the Datataker or from the computer);
- periodically recovering data and/or programming the Datataker via a removable memory card.

EXTRAS

The Real Story – Time and Date

Actually, the Datataker doesn't record the time and date along with *every* reading. To conserve memory space, it only records a few "administrative characteristics" of your logging session along with each session's data (like the start time and start date), from which it re-constructs the full log when required.

So when you unload the logged data to a computer, you can easily arrange for the time and date to be attached to each measurement like that shown in the figure above ("Chunks").

And when you command the Datataker to return data directly to a computer in "real time" — that is, as each measurement is made — instead of, or as well as, logging it in the Datataker's memory, you can have the time and date automatically added beside each returned value.

1-1.3 Data Format, Display and Storage

Your Datataker is extremely powerful and flexible in the ways it allows you to format, view and store data.

Format

You can format (layout, arrange) the data provided by your Datataker to best suit the way you want to use it.

For example, you can make it easy and meaningful to read, like

```
Boiler temperature 123.4 Deg C
```

or comma-separated ready for direct importing into a software spreadsheet, like

```
123.4,123.7,123.1,123.6
123.3,123.7,124.2,124.5
124.2,124.6,124.8,125.1
```

or with the time of each reading included, like

```
00:00:00 24.8
00:00:02 24.9
00:00:04 24.5
00:00:06 24.2
00:00:08 24.0
```

Display and Storage

You can connect the Datataker to any computer and, using appropriate software, data can be viewed on the computer screen as it is acquired. And if your Datataker has an inbuilt display fitted or a panel-mount display connected, you can also display the data on these.

Data can be stored in the Datataker's own internal memory, in a removable memory card (on most Datataker models), or you can transfer it to a computer. Once in the computer, you can store the data file ("archive" it) for later reference, or bring it into one of many spreadsheet or plotting programs for analysis. For example, you can use Microsoft® Excel to create a printed report (including graphs), or Data Electronics' "DeCipher Plus" to plot graphs of your data versus time directly on the computer screen.

1-1.4 Communication

For the computer to talk to the Datataker (this is how you control the Datataker — by sending commands to it from a computer), and for the Datataker to return data to the computer…

- you must run a communications (or "terminal") software package on the computer (explained in chapter 3, "DeTerminal Communications Software");
- you must connect the computer's communications port to the Datataker's communications port using the correct cable (explained in "Connect the Computer" in the next chapter).

Sending Commands

There are four ways you can send commands to the Datataker:

- from a computer connected to the Datataker;
- from a removable memory card — commands loaded into a memory card are automatically transferred to the Datataker and acted upon the moment the card is inserted into the Datataker's memory card socket. This is a handy way of configuring and "programming" a remote Datataker;
- using the buttons integrated with the Datataker panel-mount display (if your logger has one fitted);
- using alarms (see chapter 5).

1-1.5 Power

You can power most models of Datataker from a mains adaptor (with either DC or AC output) or from batteries, solar panels, vehicle power supplies and other DC or AC sources.

Datatakers from the DT500 series upwards are fitted with an internal battery, whereas the DT50 case, being smaller, is unable to house an internal battery — the DT50 is intended to be powered from external sources only.

Typical Usage

A common method of working with the Datataker is, while you are programming it "back at base", to power it from the mains via a mains adaptor and have a rechargeable battery connected as well. The mains adaptor powers the logger and charges the battery.

When you've finished programming and are ready to use the logger "in the field", you disconnect it from both the computer and the mains adaptor and it continues to operate from the freshly-charged battery.

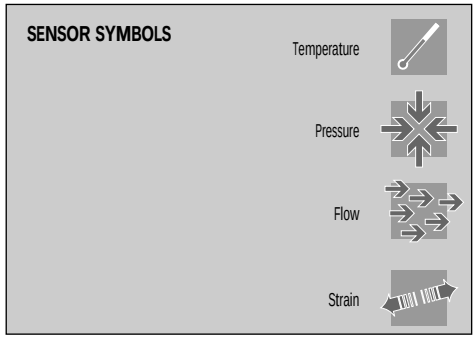
1-2 Important Terminology and Conventions

This section introduces you to some terms and conventions you'll need right away. Others are explained as they arise.

Sensors

Origins of data in a data acquisition and logging system. Sensors detect variable quantities (temperature, pressure, flow, and so on) and convert them into electrical signals. Sensors see, hear, taste, sniff or feel the environment and tell the Datataker what's going on.

In this guide, sensors are symbolised as shown in the figure below:



Datataker, Data Logger, Logger: All the Same

In this User's Guide the terms "Datataker", "data logger" and "logger" are used interchangeably — they all refer to one thing, the Datataker data logger.

Default

Your Datataker has a standard group of "default" settings — the settings you get if you don't specify anything different. When you first power-up a Datataker, or when you issue the **RESET** command, the Datataker's parameters, switches and other internal characteristics all revert to their default values or states.

Format
With Datataker, you can "format" data in a variety of ways. That is, you can arrange the physical appearance and layout of data as it comes from the Datataker so that it best suits the way you want to use it or store it.

Power-up
Applying power to a previously un-powered device. In the case of a Datataker, this resets all internal settings to their default states or values.

PC
"PC" (Personal Computer) is a generic term for an IBM (or compatible) computer. Note that it *only* refers to IBM-type computers and not to other computer platforms (the Macintosh, for example, is not referred to as a "PC").

Connector Sex
"Male" connectors are equipped with protruding pins, whereas "female" connectors have holes (to receive the pins).

COM Ports
The communications connector(s) on the back of your PC are known as "COM ports". They are easy to identify because they are the only *male* 9-pin or 25-pin D-shaped connectors on the computer. Most PCs are equipped with one or more COM ports, named **COM1**, **COM2**, and so on.

COM ports are for the transfer of serial data. Therefore they are sometimes called "serial ports".

Most Datatakers also have a COM port, labelled **RS232 COMMS**.

Comms Cable
"Comms cable" is a truncation of "communications cable". Because of differences in connectors and wiring, many different types exist.

For example, you must use a Data Electronics "IBM-1" comms cable to connect between the COM ports of your Datataker and PC. (Note that this is a special cable — you can *NOT* use any of the comms cables generally available from computer stores.)

Program, Software
A group of commands (instructions) that tells a computer what to do, and a vital tool for communicating with your Datataker. (Note that a Datataker is a dedicated, single-purpose computer.)

"Software" is sometimes used as a collective name for a group of "programs".

File, Document, Application
A "file" is the primary, most basic unit of storage on your computer. It's simply a collection of information grouped together and called by one name — for example, REPORT.DOC created by your word processor, or CHART99.XLS created by your spreadsheet program. It's a container for information, with a name.

A computer "document" is any work that *you create* (using an application program) and save in a file. Traditionally, the term refers to work created with a word processing program (for example, a letter or a book). But nowadays, it refers to *any work you create* with any application. Also known as a "data file".

An "application" is software you use to create and modify documents — for example, your word processor, spreadsheet or database program, or DeTerminal. Applications are often comprised of several files called "program files".

Floppy Disk
A removable disk that's flexible — although the *case* in which the actual magnetic medium is housed may be rigid (as it is on $3^1/_2$" "floppy disks", also known as "floppies" or "diskettes").

Characters
Things you type. The generic name for numbers (0, 1, 2, 3,…), letters (A, b, c, D,…) and symbols (µ, %, &, +,…).

↵ = Enter Key
In this User's Guide, the symbol ↵ is used to represent the **Enter** key on your keyboard. Thus the instruction

Type **`copy a: b:`**↵

means "type the characters **`copy a: b:`** then press the **Enter** key".

Typing DOS Commands

Your IBM (or compatible) computer's disk operating system (DOS) commands are shown in this User's Guide in lower case. For example:

```
copy a: b:
```

But DOS is not case-sensitive, so when typing DOS commands you can use upper case, lower case, or both. For example, the lines…

```
copy a: b:

COPY A: B:

Copy a: B:

COpy A: B:
```

are all valid and mean exactly the same in DOS.

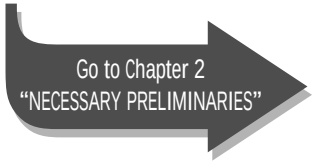
Typing Datataker Commands

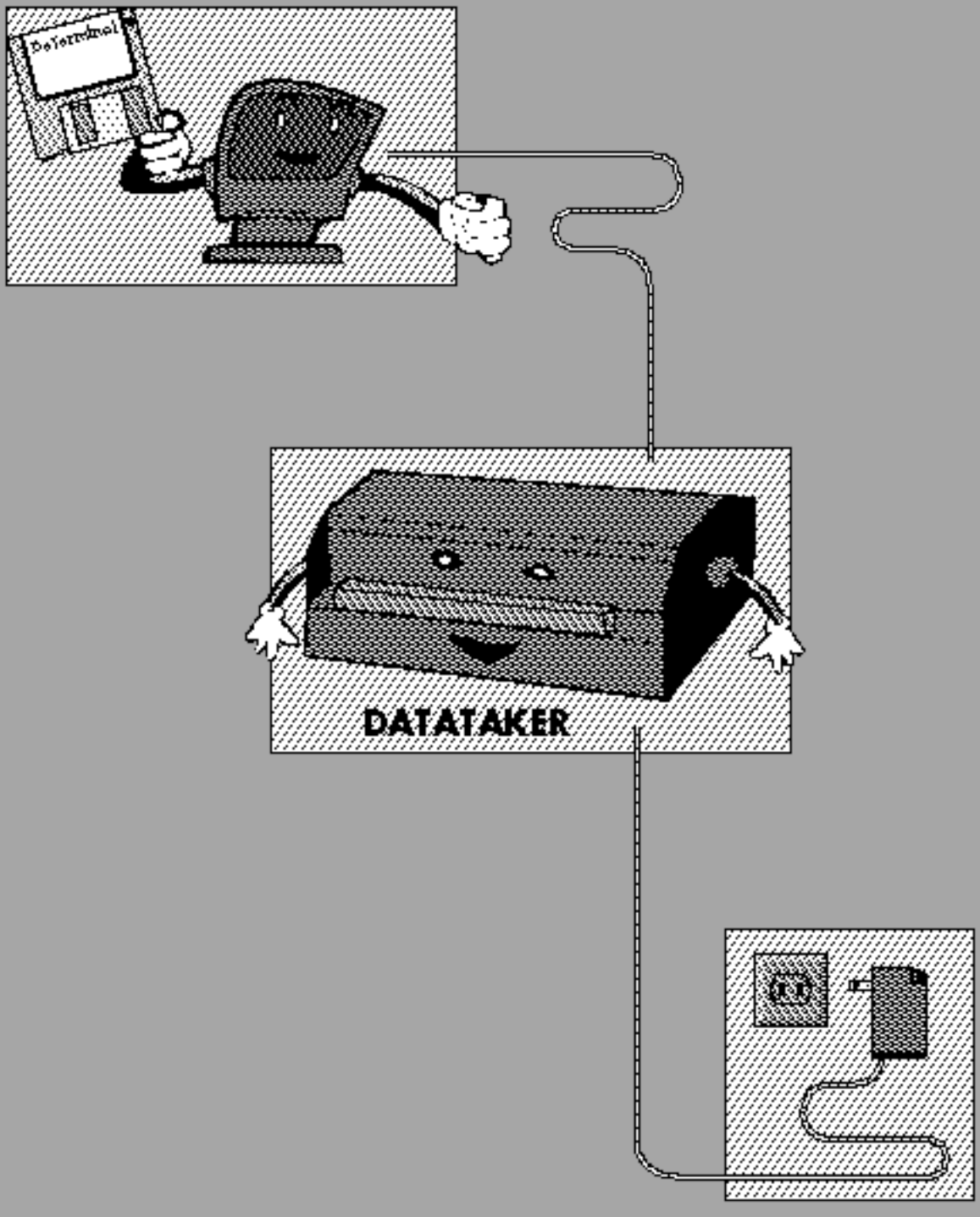
Conversely, commands you type to control the Datataker *are* case-sensitive. You'll be introduced to this later.

What's Next?

This chapter has given you a quick introduction to some fundamental Datataker data acquisition and logging concepts, terminology and conventions.

Now go to chapter 2 where you'll set up your Datataker and the computer ready to work through this User's Guide.




DATATAKER

Chapter 2

Necessary Preliminaries

In this chapter, you prepare everything you need to work right through this User's Guide.

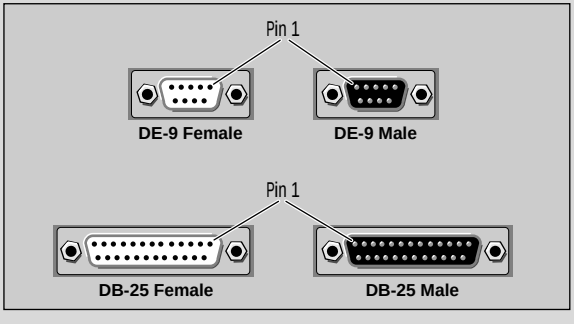
You…

- check the hardware;
- make a working copy of the DeTerminal disk (DeTerminal is the software you'll use to communicate with the Datataker — discussed in the next chapter);
- install DeTerminal software on your hard drive (if your computer has one);
- power the Datataker from the mains adaptor;
- connect the computer to the Datataker.

Comms Connectors

The connectors on the communications cable supplied with your Datataker are of the "DE" type. This is a 9-pin D-shaped connector, as shown below.

Another common comms connector is the "DB" type, which is also D-shaped but has 25 pins. We have supplied a DE to DB adaptor with your Datataker to convert one DE end of the Datataker comms cable to DB — use this adaptor if your computer's COM port is of the DB type.



2-1 Checklist

Make sure you have everything you'll need to successfully work through this User's Guide.

Check that you have the items below.

a) From your Datataker shipping box:

- ❒ a Datataker
- ❒ a 12V mains adaptor
- ❒ a Datataker communications cable (DE-9 male to DE-9 female) to connect between the Datataker and an IBM PC/AT® (or compatible) computer
- ❒ an adaptor (DE-9 to DB-25) to convert the Datataker communications cable for use with an IBM PC/XT® or PS/2® (or compatible) computer
- ❒ a flat-blade screwdriver
- ❒ a K-type thermocouple (red and yellow wires, twisted together at one end)
- ❒ a potentiometer (mounted in a pair of children's building blocks)
- ❒ "DeTerminal" software on a 3½" 720KB floppy disk
- ❒ a "Datataker Manual"
- ❒ a "Getting Started with Datataker" User's Guide (the document you're reading now)

If anything is missing, contact your supplier immediately.

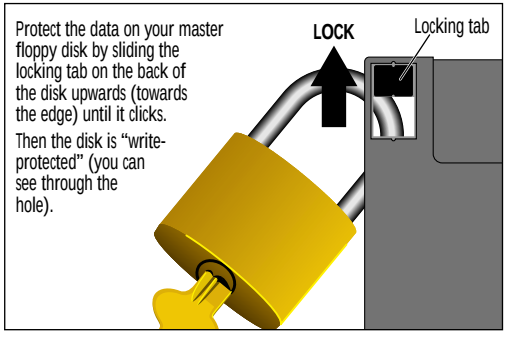
b) You also need…

- ❒ an IBM XT, AT, PS/2 or compatible computer with a 3½" floppy drive and running MS-DOS® 2.0 (or later).

2-2 Make a Backup Copy of Your DeTerminal Disk

For safety's sake, make at least one backup copy of your DeTerminal floppy disk — then store the original and use the copy:

a) Take your "master" 3½" DeTerminal floppy disk, the original one supplied with your logger, and make sure it's locked.


Protect the data on your master floppy disk by sliding the locking tab on the back of the disk upwards (towards the edge) until it clicks.
Then the disk is "write-protected" (you can see through the hole).
LOCK
Locking tab

b) Start your computer and prepare a 720K (DD) floppy disk so that it is formatted and empty. This is the "copy disk".

c) Put the original DeTerminal disk in the computer's 31/2" floppy drive.

d) Type the DOS command

`diskcopy a: a:` if the 31/2"floppy drive is drive **`A:`**

OR

`diskcopy b: b:` if the 31/2"floppy drive is drive **`B:`**

Be sure to include the space before each **`a:`** (or **`b:`**).

e) Press the **Enter** key. (From now on, the symbol ↵ will be used for your keyboard's **Enter** key.)

f) When the computer prompts you, take out the original DeTerminal disk (the source disk) and put in the copy disk (the target disk).

g) When disk copying finishes, remove the copy disk from the drive and label it something like "DeTerminal Working Copy".
Use the copy from now on.

h) Store the original DeTerminal disk in a safe place, away from humidity, heat, direct sunlight, dust and magnetic fields (electrical appliances such as computer monitors, loudspeakers and telephones generate magnetic fields).

DOS Commands

DOS, your IBM computer's Disk Operating System, is not case-sensitive. So when typing DOS commands you can use upper case, lower case, or both. For example, the lines…

```
copy a: b:

COPY A: B:

Copy a: B:

COpy A: B:
```

are all valid and mean exactly the same in DOS.

(But commands you type to control the Datataker **ARE** case-sensitive. You'll be introduced to this later.)

2-3 Copy DeTerminal to Your Hard Disk

RECOMMENDATION Although you can run DeTerminal from a floppy disk, we recommend you install it on a hard disk if your computer has one. This guide assumes you have done so.

Install DeTerminal by copying all the files from your DeTerminal disk — the working copy — to a directory named **determ** on the hard disk:

a) Start the computer if it's not already running.

b) When you're presented with the "DOS prompt" (typically, looks like **C>** or **C:\DOS>** followed by a flashing cursor — it's where DOS puts the commands you type), type

**cd **↵

to ensure you're at the root directory.

Remember that ↵ is the symbol for your keyboard's **Enter** key.

c) Type

md determ↵

to make a directory named **determ**.

d) Type

cd determ↵

to change to the new directory.

e) Insert your working copy of the DeTerminal floppy disk into the computer's disk drive.

f) Finally, copy the files from the floppy disk to the new directory by typing

copy a:*.*↵

if the floppy drive you're using is the computer's **a:** drive, or

copy b:*.*↵

if the floppy drive you're using is the computer's **b:** drive.

g) When the files have been copied (DOS tells you how many then returns you to the DOS prompt), remove the DeTerminal floppy disk and store it safely.

Alternative Computers and Software

You can also use an Apple Macintosh computer. If you have an IBM emulation program (like Insignia Solutions' SoftPC®) loaded on the Mac™, you can use DeTerminal.

Otherwise you can use a Macintosh communications program (RedRyder, White Knight, Termulator or MicroPhone™, for example). Of course, DeTerminal-specific commands (like **T=/T** and all commands preceded by a backslash ****) *will not work if you send them from any of these alternative programs.* The Extras "The Backslash Concept, and Datataker Commands versus DeTerminal Commands" in chapter 3 has more information.

Hard Disks and Floppy Disks

This tutorial assumes you are running DeTerminal from a computer's hard disk, but you can also run it directly from a floppy disk (although it will be significantly slower).

If you do run it from a floppy disk, the instructions you send to the Datataker are exactly the same, but we recommend you don't attempt to transfer large amounts of data from the Datataker to the floppy disk. This is simply because there is not much free space on the Datataker floppy disk and you might lose data which overflows. (DeTerminal has a storage overflow warning indicator, but it's beyond the scope of this User's Guide.)

Data overflow doesn't stop the Datataker from scanning and logging data.

2-4 Connect the Mains Adaptor

Now provide power to the Datataker from the mains adaptor.

Connect the mains adaptor supplied to the external power terminals of the Datataker:

a) Using the small screwdriver provided with your Datataker, connect the bared ends of the mains adaptor's leads to the two AC/DC terminals on the logger: they are labelled ~ on the Datataker 50, and **AC/DC** on the Datataker 500 and 600 models (see the diagram "External Power Terminals").

On a DT50, the connector block which houses these terminals is a plug-in type, which can be removed and replaced by hand.

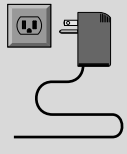
b) Plug the mains adaptor into a wall outlet and switch on at the wall. The DT50 will start flashing its "little red light" the moment power is applied (see Extras "The Little Red Light").

Other models, which have an internal battery and are shipped with it charged and connected, will be in sleep mode and will stay that way until the logger is awakened (using DeTerminal — next chapter). Therefore the red indicator will not flash on these models.

EXTRAS

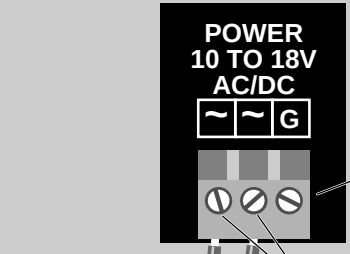
Mains Adaptor

… converts mains power (from a wall outlet) to a voltage suitable for the Datataker.



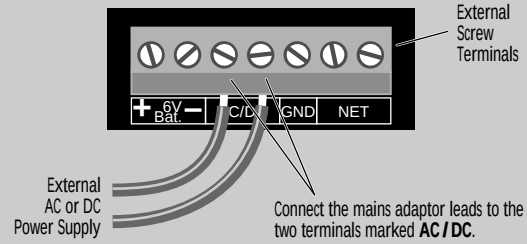
EXTERNAL POWER TERMINALS ("AC/DC POWER")

Datataker 50


POWER
10 TO 18V
AC/DC
~ ~ G
External Screw Terminals
(This is a plug-in connector block on the DT50, removable by hand.)
External
AC or DC
Power Supply
Connect the mains adaptor leads to the two terminals marked ~.

NOTE:
It doesn't matter which lead goes into which **AC/DC** terminal for the purposes of this manual, but refer to the Extras "Grounding a DC Power Supply" overleaf for the full story.

Datataker 500 and 600 Series



NOTE:
It doesn't matter which lead goes into which **AC/DC** terminal for the purposes of this manual, but refer to the Extras "Grounding a DC Power Supply" overleaf for the full story.

The screw terminal acts like a small vice:

1. Undo the screw by turning it anti-clockwise (with the screwdriver) and the vice opens.
2. Insert the bared wire.
3. Turn the screw clockwise and the vice closes. Tighten the screw firmly to clamp the wire in the terminal.

The Little Red Light

Most models of Datataker are equipped with an external red LED (light-emitting diode) indicator. Depending on the model, it is labelled either **Sample**, **Convert** or **Converting**. Its purpose is to give you a visual indication of the logger's operation by flashing each time the Datataker makes a measurement.

Even when the Datataker is not measuring any sensors you'll notice the indicator flashing briefly every second (this is the Datataker monitoring its own internal power circuits) — except when the Datataker goes to sleep (see "Sleep Mode" below).

Sleep Mode (Low Power Operation)

To conserve battery power, the Datataker "goes to sleep" if it has been inactive (no measurements, no communication) for a period of 30 seconds. This applies only if the Datataker is powered by battery alone. It never sleeps (unless specifically instructed to do so) when power is provided via the external AC/DC power terminals — by a mains adaptor, for example.

In sleep mode, most of the internal electronics shuts down. The current drain drops from 120mA when awake to only 400µA when asleep.

The Datataker wakes…

- when a measurement is due;
- when you communicate with it;
- when you insert or remove a memory card;
- when you activate the **Wake** terminal (by grounding the terminal);
- when you press a key on the external display (if fitted);
- every 18 minutes (for time-keeping purposes).

Three Types of Power Connections

There are three types of Datataker power connections to be aware of: an "external AC/DC power" connection, an "external battery" connection and — for the DT500/600 series only — an "internal battery" connection. These are described below:

- **External AC/DC Power (external screw terminals)**
  These are on the outside of the Datataker, labelled **~** on the DT50 and **AC/DC** on the DT500/600 series, and are intended for the connection of a mains adaptor (AC or DC output) or an external battery.

- **External Battery (external screw terminals)**
  These are also on the outside of the Datataker, labelled **Battery/Alkaline/Lead-acid** on the DT50 and **6V Bat.** on the DT500/600 series.
  Do NOT connect anything but a 6V gel cell or a 9V alkaline battery to these terminals. (Although alkaline batteries are not rechargeable, you can connect a 9V — but not a 6V! — alkaline battery to these terminals without danger.)
  The external battery terminals differ from the AC/DC power terminals in two ways:
  - they are for the connection of an external battery or other DC power source only (*repeat: DC only — not AC*);
  - a charging current is available at these terminals whenever power is supplied via the AC/DC power terminals (for example, when a mains adaptor is connected).

  If you connect an external battery to a DT500/600 series logger *when its internal 6V gel cell battery is installed*, the external battery *must also be a 6V gel cell* and it must be connected to the external battery terminals with the correct polarity otherwise damage *will* occur.

- **Internal Battery (internal 3-pin connector, DT500/600 series only)**
  The DT500/600 series loggers are supplied with a 6V lead-acid rechargeable battery ("gel cell") fitted inside the Datataker. This battery is automatically charged whenever power is supplied via the AC/DC terminals.

  It is not possible to fit a battery inside the DT50 case, therefore the DT50 does not have an internal battery connector.

2-5 Connect the Computer

For the computer to talk to the Datataker, and the Datataker to return data to the computer, you must connect the computer's communications port to the Datataker's communications port using the correct communications cable.

This User's Guide assumes you are using an IBM (or compatible) computer and the communications cable supplied with your Datataker.

In this section, you use the communications cable to connect between the Datataker's COM port and a free COM port on your computer (see "COM Ports" in the Extras below).

Make sure there is no software (a mouse driver, for example) configured to access the COM port you plan to use with the Datataker:

a) If there is such software, do one of the following:
- re-configure it (so that it uses a different COM port);
- unload it while you use DeTerminal (you'll have to remember to do this every time you run DeTerminal);
- delete it.

Then take the communications cable supplied and connect it between the logger and the computer:

Datataker End

a) Plug the 9-pin male connector of the Datataker communications cable into the socket on the Datataker labelled **RS232 COMMS**.

Computer End

This step is dependent on the type of computer you are connecting to:

b_1) **IBM AT Computer (or compatible)**
Plug the female 9-pin connector into the computer's COM port.

b_2) **IBM XT Computer (or compatible)**
Plug the 9- to 25-pin adaptor (supplied) into the female 9-pin connector at the free end of the cable. Then plug the adaptor into the computer's COM port.

b_3) **Macintosh Computer**
You can't use the cable supplied with your Datataker. Either order the correct cable, or make your own using the wiring diagram in the section "COMS Port" in your "Datataker Manual", or "The RS232 COMMS Serial Interface — Wiring the Host Computer or Terminal Cable: Communication Cable for Apple Macintosh" section of the "Reference Manual for the Datataker Data Loggers".

PC

"PC" (Personal Computer) is a generic term for an IBM (or compatible) computer. Note that it *only* refers to IBM-type computers and not to other computer platforms (the Macintosh, for example, although it really is a personal computer, is not referred to as a "PC").

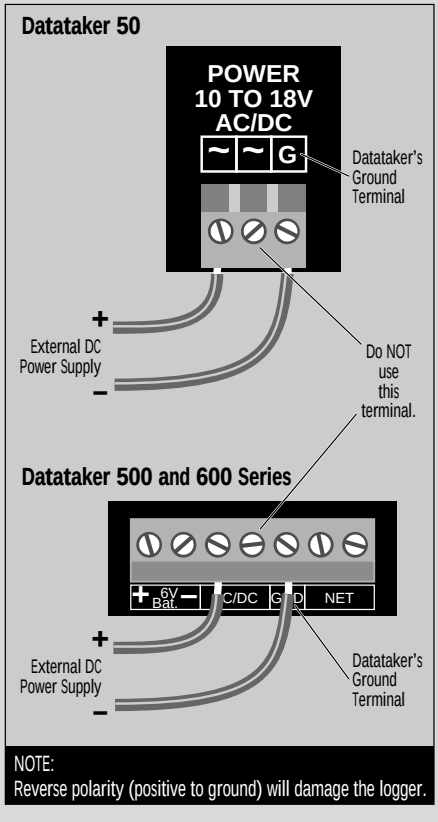
COM Ports

The communications connector(s) on the back of your PC are known as "COM ports". They are easy to identify because they are the *only* **male** 9-pin or 25-pin D-shaped connectors on the computer. Most PCs are equipped with one or more COM ports, named **COM1**, **COM2**,…
COM ports are for the transfer of serial data. Therefore they are sometimes called "serial ports".

EXTRAS

Grounding a DC Power Supply

If you use a DC power supply and your application requires it to be grounded to the Datataker's ground, you must connect the *supply <u>negative</u> to the Datataker ground*, as shown below:



On the other hand, if your external supply is "floating" relative to the logger (that is, not connected to the logger's ground via any external equipment, sensor, wiring,…) then the polarity of the power supply connection is not important — you can connect the two leads from either an AC or DC power supply to the logger's external power terminals (**~** or **AC/DC**) *either way round.*

What's Next?

So far, you've prepared everything you need to work right through this User's Guide — you've checked the hardware, made a working copy of the DeTerminal disk, installed DeTerminal on your hard drive (if your computer has one), powered the Datataker from the mains adaptor, and connected the computer to the Datataker.

Now you're ready to learn about DeTerminal, which is the software you run on your computer when you want to communicate to and from the Datataker.

Go to Chapter 3 "DeTerminal"

Battery Advice

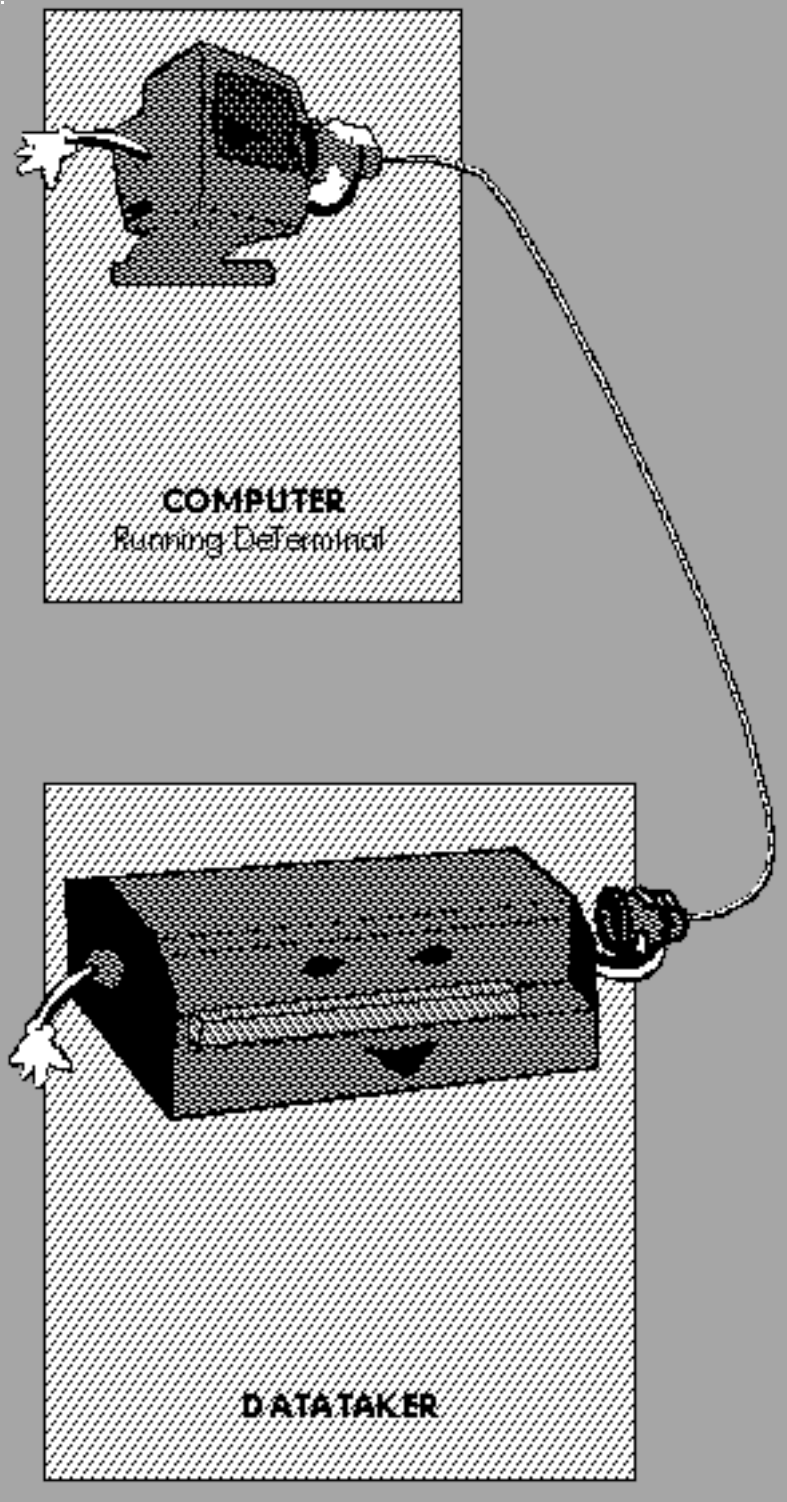
In addition to the battery's usual function of powering the logger in the field, we advise you to keep a battery (preferably a rechargeable type) connected to the Datataker at all times. This is to provide backup power in case the primary power supply (usually a mains adaptor) is accidentally disconnected or fails.

Flat Gel Cells

Don't let gel cell batteries remain flat for any length of time — their service life will be significantly reduced.

6V, 12V?

Why do the DT500 and 600 series loggers use a 6V internal battery but are supplied with a 12V mains adaptor?… Because the mains adaptor has to be able to supply the Datataker *and* charge the internal battery (and any battery connected to the external battery terminals).


COMPUTER
Running DeTerminal
DATATAKER

DeTerminal Communications Software

"DeTerminal" is communications software supplied by Data Electronics. You use it to supervise the Datataker — to send commands to the Datataker, and to receive information back.

Although you can use any communications software running on any computer to supervise the Datataker, this User's Guide assumes you are using DeTerminal software on an IBM (or compatible) computer.

DeTerminal is not copy-protected. You may copy and distribute it freely.

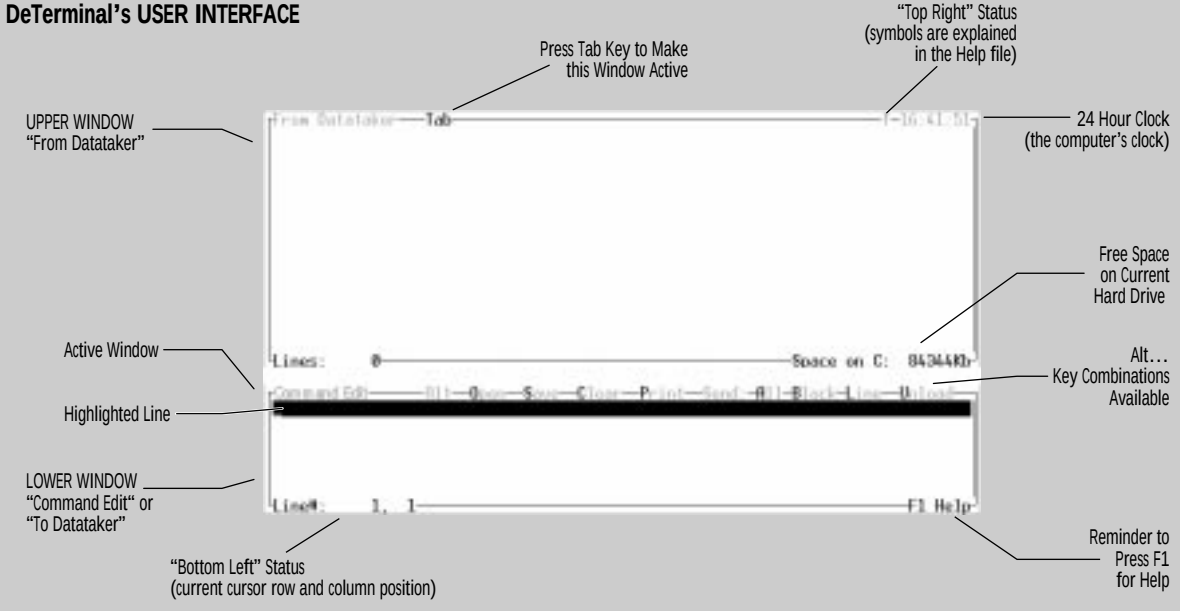
Appendix Two at the end of this guide is a list of basic DeTerminal keystrokes. For a complete key summary and a description of all the DeTerminal commands, see the "DeTerminal User's Manual" (available from Data Electronics) or DeTerminal's HELP file.

3-1 Introduction to DeTerminal

DeTerminal is a PC software package designed specifically for two-way communication with Datatakers. It's a simple text editor and a terminal emulator together in one software package.

Moreover, it has been optimised for data acquisition and logging tasks. For example, the DeTerminal screen has two windows: the lower window shows commands you send *to* the Datataker, and the upper window shows output *from* the Datataker. Compare this with other communications packages, which mix the input and output information together in one window, making it difficult to know what's happening.

DeTerminal's USER INTERFACE


Press Tab Key to Make this Window Active
"Top Right" Status (symbols are explained in the Help file)
UPPER WINDOW "From Datataker"
24 Hour Clock (the computer's clock)
Free Space on Current Hard Drive
Active Window
Alt... Key Combinations Available
Highlighted Line
LOWER WINDOW "Command Edit" or "To Datataker"
"Bottom Left" Status (current cursor row and column position)
Reminder to Press F1 for Help

3-2 Start DeTerminal

Run DeTerminal on your IBM (or compatible) PC as described below.

Firstly, check that…

- power is supplied to the Datataker via the mains adaptor (the wall outlet must be ON);
- the two commands FILES and BUFFERS in your computer's CONFIG.SYS file specify values of at least 20 each — that is, the commands should read, at least, **`FILES=20`** and **`BUFFERS=20`** (use a text editor if you need to increase either of these values — refer to your DOS manual — and restart your computer for the changes to take effect);
- the computer's COM port is connected to the Datataker's COM port by the comms cable supplied;
- the computer is turned on and you can see the DOS prompt on the screen, ready for you to type.

Secondly, start DeTerminal:

a) Make sure you're in the **`determ`** directory you created earlier by typing

```
cd determ↵
```

(This is your last reminder in this section that ↵ is the symbol for your keyboard's **Enter** key.)

The DOS prompt should now look something like

```
C:\determ> _
```

Next you have three options:

b_1) If the Datataker is connected to your computer's **`COM1`** port, type

```
dt↵
```

DeTerminal will respond with the message "Looking for Datataker", then "Found at 1200 baud".

b_2) If the Datataker is connected to your computer's **`COM2`** port, type

```
dt com2↵
```

DeTerminal will respond with the message **`Looking for Datataker`**, then **`Found at 1200 baud`**.

b_3) If you don't know which COM port the Datataker is connected to, try sub-step b_1 above. If DeTerminal responds with the successful connection message **`Found at xxxx baud`**, the Datataker is connected to **`COM1`** and you can proceed directly to the next step in these instructions.

If DeTerminal responds with **`Not found`**, exit back to DOS (use the ⬇ arrow key on your keyboard to highlight **`Exit DeTerminal now`**, then press the **Enter** key) and try sub-step b_2 above. If DeTerminal responds with the successful connection message **`Found at xxxx baud`**, the Datataker is connected to **`COM2`** and you can proceed directly to the next step in these instructions.

But if DeTerminal still responds with **`Not found`**, go to "Troubleshooting" in the Extras below.

When DeTerminal has successfully established communication with the Datataker, you are presented with DeTerminal's user interface as shown in the figure "DeTerminal's User Interface" on the previous page. It consists of two windows, one above the other:

- the upper window shows information received back from your logger and is called the "From Datataker" window;
- the lower window shows information you send to your logger and is called the "Command Edit" window. This is the text editor window where you type commands and send them to the Datataker, save them for later use, or print them.

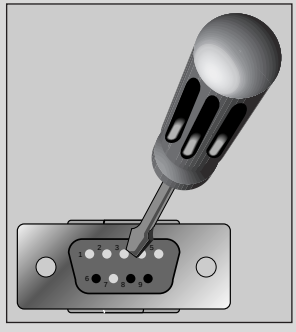
Troubleshooting

If DeTerminal responds with **`Looking for Datataker: Not found`**, try the following:

- Check that the comms cable's connectors are firmly plugged in to their sockets, the mains adaptor's leads are properly inserted in the logger's AC/DC terminals, and that the mains adaptor is turned on at the wall. Then choose the **`Look again`** option in DeTerminal's **`Looking for Datataker`** dialog box (to do this, highlight **`Look again`** using the ⬆ and ⬇ arrow keys then press the **Enter** key).
- If the computer has more than one COM port, swap the comms cable to the other port, then choose the **`Look again`** option in DeTerminal's **`Looking for Datataker`** dialog box (to do this, highlight **`Look again`** using the ⬆ and ⬇ arrow keys then press the **Enter** key).
- Check there is no software loaded which is configured to access the COM port to which you have connected the Datataker (a mouse driver, for example). Either re-configure, unload, or delete the problem software (or use another port).
- **Manually Reset the Datataker**
  - DT500/600 Series
    There are two ways to manually reset a DT500/600 series Datataker.
    Either… insert the shaft of a small screwdriver (or a straightened paper clip) all the way — about 2cm — into the hole labelled **Reset** (not **Cal**) beside channel 10's terminals. Hold the screwdriver against the bottom and lean it sideways so that it touches the side of the hole — your object is to short-circuit the edge of the hole to the pad at the bottom of the hole.
    Or… disconnect all power (including the internal battery), then reconnect it.
    For either method, confirm that the red **Sample** or **Convert** LED (light-emitting diode) is flashing every second.
  - DT50
    To manually reset a DT50, disconnect all power by unplugging the external power connector(s), then plug it (them) in again. Confirm that the red **Converting** LED is flashing every second.

  Having manually reset the logger, choose the **`Look again`** option in DeTerminal's **`Looking for Datataker`** dialog box.

- **Test DeTerminal, Your Computer and the Comms Cable**
  You can verify that all these components are operating correctly using one simple test.
  Choose the **`Continue anyway`** option in DeTerminal's **`Looking for Datataker`** dialog box and type a few characters (anything) in DeTerminal's lower window. Unplug the communications cable *from the Datataker* and locate pins 3 and 4 of the free male DE-9 connector (the one you just unplugged) — see the figure below. Using, say, the blade of the small screwdriver supplied with your Datataker, short-circuit (connect) pins 3 and 4 together *without touching the screwdriver against the **body** of the connector*. Now send the characters you typed previously (**Alt L**) — you'll probably need a third hand to do all this.

  ✓ If the characters appear in DeTerminal's *upper* window, then DeTerminal, your computer, its COM port, and the comms cable are OK. Therefore any problem can only be with the remaining component of your system, the Datataker, so make sure you've manually reset it as described above.

  ✘ If nothing appears in the upper window when you send the line, there is a problem with either DeTerminal, your computer, its COM port, or the comms cable.
  If the computer has more than one COM port, swap the comms cable to the other port and test again. This is a likely cause of the problem and is quick to check.
- **Test the Mains Adaptor**
  Use a multimeter to check the output of your mains adaptor.

If DeTerminal is still unable to find the Datataker after you've done everything above, contact Data Electronics or your dealer.

Flat Battery

If your logger has a battery connected which is completely discharged, wait 5 minutes after applying power via a mains adaptor before manually resetting or "looking again" for the Datataker — a flat battery must receive a few minutes' charge before the logger's internal power circuitry can stabilise.

Thirdly, optimise the appearance of your computer screen by pressing the **F2** key repeatedly to cycle through the available screen colour combinations. Stop when you get the best display for your monitor. This can be particularly helpful for monochrome LCD screens.

3 - 3
DeTerminal Basics

This section contains basic information you'll need to be familiar with to use DeTerminal.

General

You use DeTerminal by typing commands and comments in the lower window then sending them to the Datataker.

These commands (or command files — explained in chapter 6) can be as simple as one line containing one character, or many lines containing up to 250 characters each. You can send one line at a time to the Datataker, or send them all at once.

Both of DeTerminal's windows can be scrolled (to see contents of the window that have moved out of view), saved (to be used later), cleared, and printed.

DeTerminal has a context-sensitive HELP file — see the Extras below.

Problem Software

Problems can occur if your computer has software loaded which accesses the same COM port to which the Datataker is connected (a mouse driver, for example). Either re-configure (or unload or delete) the problem software, or connect the Datataker to another COM port.

Baud Rate

A measure of how fast data is transmitted (how much information per second). The term comes from the name of a French communications pioneer, J. M. E. Baudot (1845–1903).

Automatic Baud Rate Selection

Every time you start DeTerminal, it automatically establishes communication with the Datataker — at the Datataker's Baud rate.

DeTerminal's HELP File

This User's Guide explains only some of the basic features of DeTerminal. For more details in quick-reference form, press the **F1** key on your keyboard when you have DeTerminal running. This launches the **HELP** file, which you can read on your screen. It's context-sensitive, so it automatically presents you with the help screen that relates to what you're currently doing in DeTerminal.

To print out the **HELP** pages, connect a printer to your computer, hold down the **Alt** key and momentarily press the **P** key (that is, press the key combination **Alt P**).

COM Ports

The communications connector(s) on the back of your PC are known as " COM ports". They are easy to identify because they are the *only male* 9-pin or 25-pin D-shaped connectors on the computer. Most PCs are equipped with one or more COM ports, named **COM1**, **COM2**,…

COM ports are for the transfer of serial data. Therefore they are sometimes called "serial ports".

DeTerminal is Different

Most communications software sends each character to the logger as you type it — character by character. Then when you press the **Enter** key, the logger processes all the information typed since you previously pressed **Enter**.

But Data Electronics' "DeTerminal" is a communications software package specially optimised for data acquisition and logging, and it operates a little differently. For example, in the case of sending a line of information to the logger, you type the line but no information is sent or processed until you press a special two-key combination when you've finished the line. This means you can compose one or more lines of commands — and edit them to make sure they're what you want (and, most importantly, that they're correct) — all before sending them to the Datataker. And with two windows, your commands are always in front of you, readily available for more editing and re-sending. Also, you can do two things at once: compose new commands in the lower window while watching data being returned from the Datataker in the upper window.

This key combination is **Alt L** — that is, you hold down the **Alt** key and momentarily press the **L** key. You will use this key combination often to send a line of data and have the Datataker process it.

Send One Line, or Send All Lines

When you're sending information to the Datataker, you can send…

- just one line, the current (highlighted) line in the lower window, using the **Send Line** key combination **Alt L** (hold down the **Alt** key and momentarily press the **L** key — you'll use this key combination often to send a line of data and have the Datataker process it.);
- all lines in the lower window (using the **Send All** key combination **Alt A**).

Text Editor

The lower window, **Command Edit**, works like a simple text editor (word processor). You can enter any number of lines of text (maximum of 250 characters per line) and move to the next line by pressing the **Enter** key.

You can save the text you enter and bring it back into the lower window later, or you can clear it or print it.

Moving Between Windows (Tab key)

Although *both* of DeTerminal's windows are open at the same time, you can only make *one* of them active (for keyboard input) at a time. You must consciously select which window you wish to work with (make active), and you do this using the **Tab** key.

In DeTerminal, the **Tab** key is a "toggle" — that is, with each successive press of the **Tab** key, DeTerminal alternates the states of its two windows; from active, to passive to active,… and so on.

The active window is easily identified by the line of commands (Alt—…—Save—Clear—Print—…) along the top border of the window.

The passive window simply has the word "Tab" at the top border reminding you to press the **Tab** key when you want to make that window active.

Upper and Lower Case

Whereas DOS is not case-sensitive, the Datataker only responds to commands typed in UPPER CASE (with one exception — "switches", discussed later).

DeTerminal's default is to start automatically in the lower window (**Command Edit**) with **CapsLock** on — so it's all ready for you to type in the text editor window in upper case.

Lower Window – Two Modes

The lower DeTerminal window has two modes:

- **Command Edit** mode is the default (that is, DeTerminal is shipped with the lower window in this mode).
  In **Command Edit** mode, the lower window behaves like a true text editor — the **Enter** key takes you to a new line.
- **To Datataker** is the alternative mode.
  In **To Datataker** mode, the lower window behaves like a terminal emulator — the **Enter** key sends the line you've just typed to the Datataker (as well as taking you to a new line).

You toggle between the two modes by pressing the key combination **Alt F10** — that is, while holding down the **Alt** key, each press of the **F10** key (at the top of the keyboard) changes the window's mode.

Each time you start DeTerminal it remembers how you had it set up last and launches immediately in that configuration. For example, if you change to **To Datataker** mode and then exit DeTerminal, it will start in **To Datataker** mode next time.

Window Sizes

You can use the function keys **F3** and **F4** to change the relative sizes of the upper and lower windows. Each press changes the sizes by one line.

Holding down the **Shift** key and momentarily pressing the **F3** key increases the *lower* window to its maximum size. Holding down the **Shift** key and momentarily pressing the **F4** key increases the *upper* window to its maximum size.

Include Comments

You'll find it helpful to include comments along with the commands you type in DeTerminal's lower window. Comments are simply text that reminds *you* about the instructions you're sending — they have no effect on the Datataker.

There are two types of comments:

- "Sent comments" are sent to the Datataker but are ignored (stripped out) by it.
  You prefix a sent comment with the **'** character (apostrophe or foot mark), which the *Datataker* interprets as "ignore the remainder of this line". For example, if you send

  ```
  T 'This gets the time
  ```

  everything on that line after the apostrophe is ignored by the Datataker.
  You may find sent comments useful because they can be echoed back to DeTerminal's upper window by the Datataker (discussed later).
- "Unsent comments" are not sent to the Datataker at all. This saves communication time between DeTerminal and the logger because only *commands* are transmitted. (In some cases, comments can account for up to 90 percent of the information a user types in DeTerminal's lower window, and it's simply a waste of time to transmit these to the Datataker — especially if you're communicating with the Datataker by modem.)
  An unsent comment begins with the two characters **\'** (backslash and apostrophe/foot mark), which DeTerminal interprets as "do not transmit the remainder of this line to the Datataker". Therefore, although anything you type after **\'** in a line is never seen by the Datataker, it remains in DeTerminal's lower window (and in the text file you create if you save the contents of the lower window; **Alt S**) — as a prompt for yourself or others using the instructions in the future. For example, in the line

  ```
  T \'This gets the time
  ```

  DeTerminal only sends the **T** to the Datataker. The rest serves to remind you of the line's function.

3-4 Practise Sending Commands to the Datataker

So far, you've been introduced to the Datataker and DeTerminal software. Now, at last, it's time to send commands to the Datataker and watch it respond.

In the remainder of this chapter you…

- send commands to configure the Datataker (that is, make internal adjustments to its basic set-up):
  - check the Datataker's time and date
  - test the Datataker
  - ask the Datataker to report its current configuration ("status");
- send commands to cause the Datataker to return information about itself to you;
- learn about…
  - "parameters" and how powerful they are
  - "switches" and some of their uses.

In the next chapter you'll command the Datataker to read a sensor.

Upper/Lower Case

This has been stated already, but it's important enough to repeat.

Whereas DOS is not case-sensitive, the Datataker *only* responds to commands typed in UPPER CASE (with one exception — "switches", discussed later).

DeTerminal's default is to start automatically in the lower window (**Command Edit**) with **CapsLock** on — ready for you to type in the text editor in upper case.

3-4.1 What's the Time?

You should have DeTerminal's two windows on your screen with the cursor flashing in the active lower window, the **Command Edit** window.

Command the Datataker to return its current time setting:

a) Type

```
T
```

Make sure that's an upper-case **T**. (The single character **T** is the command for "return the real time".)

b) Now *send* this Control Command to the Datataker by holding down the **Alt** key and momentarily pressing the **L** key (that is, type the key combination **Alt L**).

c) A short time later, the Datataker responds (in DeTerminal's upper window) with two lines of text similar to

```
T
Time 01:15:30
```

- The first line is the "echo", a repeat of the command you just sent.
- The second line is the current time, as you requested. (The Datataker's "current time" is the time since it was powered up or reset — in the example above; 1 hour, 15 minutes and 30 seconds.)

Echo

The "echo" lets you check that the Datataker is actually receiving your commands. Once you're confident that it is receiving, you can turn the echo off. This is explained in a later step.

3-4.2 What's the Date?

Command the Datataker to return its current date:

a) Type

```
D
```

Make sure that's an upper-case **D**. (The single character **D** is the command for "return the date".)

b) Now *send* this Control Command to the Datataker by typing the key combination **Alt L**.

c) A short time later, the Datataker responds (in DeTerminal's upper window) with something like

```
D
Date 07/01/89
```

- The first line is the echo, a repeat of the command you just sent.
- The second line is the date, as you requested. (The "date" returned by a new Datataker is 01/01/89 *plus* the number of days since it was powered-up or reset. Later we'll explain how to set the Datataker's date to be the same as the actual date.)

3-4.3 TEST the Datataker

Sending the **TEST** command forces the Datataker to re-calibrate and test some of its internal electronic components, and report various internal characteristics.

Send the **TEST** command to the Datataker:

a) Type

```
TEST
```

(all upper-case characters) in DeTerminal's lower window, the **Command Edit** window.

b) Send this line to the Datataker (**Alt L**).

c) A short time later, the Datataker responds with

```
TEST
Datataker 52  Ver x.xx
VDS (mV) 0.054
...
...
Ics2(µA) 249.4
PASS
```

- The first line is the echo, a repeat of the command you just sent.
- The following lines are the values of internal characteristics of the Datataker.
- The last line is the overall result of the test, PASS or FAIL.

Date Format

Datatakers are shipped from the factory pre-configured for either the USA or Europe. So if you bought your Datataker in North America (USA or Canada), it will return dates to you in mm/dd/yy format (month first, day second). If you bought your Datataker anywhere other than North America, it will return dates to you in dd/mm/yy format (day first, month second).

You are not locked into this country-specific formatting. Your Datataker's characteristics can be easily reset any time you choose by sending commands, and you can reset the Datataker's *default* date format using an internal switch on the logger's circuit board (also sets the mains frequency — see the other Datataker manuals).

3-4.4 Send the STATUS Command

The **STATUS** command asks the Datataker to report its current configuration.

Send **STATUS** to the Datataker:

a) Type

```
STATUS
```

in the **Command Edit** window.

b) Send this line (**Alt L**).

c) A short time later, status information is returned to the upper window (see the figure below).

- The first line is the echo, a repeat of the command you just sent.
- The following lines report your Datataker's configuration.

Don't worry about making sense of these lines returned to you in DeTerminal's upper window. At this stage you're only practising sending commands to the Datataker.

Next, you'll use this skill to alter some of the Datataker's internal settings — its "parameters".

TYPICAL INFORMATION RETURNED BY THE STATUS COMMAND

DeTerminal's Upper Window

From Datataker—Tab

```
STATUS
Datataker 0 Version x.xx
none,none Scan Schedules Active,Halted
0,0 Alarms Active,Halted
0 Polynomials/Spans Defined
Logging is OFF
13650,0 Internal Data Points Free,Stored
No Card Inserted
No Card Inserted
/a/C/d/E/f/h/J/K/l/m/N/o/t/U/v/w/x/y/Z
```

3-5 Practise Reading and Setting PARAMETERS (P...)

"Parameters" are internal configuration settings of the Datataker. Parameter commands are used to set things like…

- the style of the Datataker's date and time (how the date and time are formatted);
- whether temperature readings are converted into ºC, ºF, ºK or ºR;
- how long the Datataker will wait for a password to be entered (if one has been defined).

There are approximately 40 Datataker parameter commands, but the important thing to know about them is that they can only have values *within a pre-determined range*. For example, to choose the Datataker's units of temperature you enter one of the numbers 0, 1, 2 or 3. Or to choose the separator character within time readings you enter one of the numbers between 1 and 127.

Parameters are named with a **P** followed by a number. **P0** (that's a **P** followed by the number zero, **Ø**), **P1**, **P2**, **P3**,… are examples of parameter names.

When Does a Parameter Take Effect?

Immediately. That is, from the moment you send it to the Datataker.

The Complete List

This User's Guide introduces you to the concept of parameters and how to apply them, and shows you a few examples. If you want detailed information about the Datataker's parameters, they are tabulated in the "Datataker Manual" supplied with each new Datataker, and the "Reference Manual for the Datataker Data Loggers" available separately. They are also listed in DeTerminal's **HELP** file (press the **F1** key when DeTerminal is running).

Now...

Practise reading and setting parameters to configure your Datataker.

Like an Elephant

The Datataker remembers everything.

From the moment you unpack a new Datataker, it has a specific internal configuration — its default settings. And when you send a parameter or switch command to your Datataker, it alters that setting *and stays set that way* until you send another parameter or switch command to override the previous one, or until you send the **RESET** command (which returns *all* settings to their default state).

For example, if you send **P39=2** to your Datataker, it sets parameter 39 to the value 2 *and keeps this setting* — no matter how many commands, schedules or command files you send to the Datataker — until you either send a new value for P39 or send **RESET**.

Similarly, the Datataker keeps running according to its existing schedules (explained in chapter 6) *no matter what* — until you send a new schedule or a command to clear the schedules.

Always Something

Every characteristic of your Datataker always has a specific value, state or setting. If you **RESET** the Datataker, its internal settings are not forgotten — they are returned to specific values (their default values).

3-5.1 Read the Time Parameter (P39)

The format of your Datataker's time is controlled by parameter number 39 — called **P39**.

Find out the current setting of **P39**:

a) Type just the parameter name

```
P39
```

This line is the parameter command for "read the time parameter". Be sure to type an upper-case **P**, no spaces.

"Numeric Keypad" in the Extras below has information concerning the typing of numbers in DeTerminal.

b) Now send the line to the Datataker (**Alt L**).

c) The Datataker responds with

```
P39
  0
```

- The first line is the echo, a repeat of the command you just sent.
- The second line is the parameter's current value, **0**. If you look up this value in a Datataker Parameters Table (in other Datataker manuals or DeTerminal's HELP file) you'll find that P39=0 means your Datataker is currently configured to format all time readings as hh:mm:ss (hours then minutes then seconds).

Numeric Keypad

DeTerminal's default is **Num Lock** off. In this state, you can only type numerals from the number keys along the top of your computer's keyboard, and the number keys on the numeric keypad to the right of your keyboard perform various scrolling and cursor movement functions which are explained in the **HELP** file (accessed by pressing F1 when running DeTerminal).

3-5.2 Change the Time Parameter (P39=...)

In the previous step you found out that your Datataker's time parameter P39 is set to a value of 0, which causes times to be returned in hh:mm:ss format.

Now suppose you want to return time in decimal hours instead, which could be useful if you plan to import the readings into a spreadsheet.

P39 has to be set to a value of 2 to change the time format to decimal hours (hh.hhh).

Set **P39** to **2**:

a) Type

```
P39=2
```

b) Send the line to the Datataker (**Alt L**).

c) The Datataker responds with just the echo

```
P39=2
```

d) Check that the time format has changed by sending

```
T
```

(You should have typed **T**, then **Alt L**.)

e) The Datataker responds with something like

```
T
Time 22.76584 Hours
```

which is decimal format.

Now set **P39** to **1**.

a) Send the line

```
P39=1
```

b) The Datataker responds with just the echo

```
P39=1
```

c) Check the time format by sending

```
T
```

e) The Datataker responds with something like

```
T
Time 82670 Secs
```

which is "seconds since midnight" format.

So by setting P39 to one of its three possible values you can choose the format of your Datataker's time readings.

The Internal Clock

Your Datataker contains a 24-hour clock with a resolution of one second.

Spreadsheet

Software for recording, calculating and analysing data. Each item of data is entered in a "cell", and the cells are arranged in rows and columns for easy reference and manipulation. Many spreadsheet programs (Microsoft Excel, for example) are capable of presenting data pictorially (bar graphs, line graphs, pie graphs, and so on).

3-5.3 Read the Date Parameter (P31)

The format of your Datataker's date is controlled by parameter number 31 — **P31**.

Find out the current setting of **P31**:

a) Type just the parameter name

```
P31
```

This line is the parameter command for "read the date parameter". Be sure to type an upper-case **P**, no spaces.

b) Send the line to the Datataker (**Alt L**).

c) The Datataker responds with

```
P31
 1
```

(or **2** for USA-configured models).

- The first line is the echo, a repeat of the command you just sent.
- The second line is the parameter's current value, **1**. If you lookup this value in a Datataker Parameters Table (in other Datataker manuals or DeTerminal's HELP file) you'll find that P31 = 1 means your Datataker is currently configured to format all date readings as dd/mm/yy (days then months then years, European style).
  Datatakers factory-set for the USA will respond with P31=2 (mm/dd/yy).

3-5.4 Change the Date Parameter (P31=...)

In the previous step you found out that your Datataker's date parameter P31 is set to a value of 1(or 2 in North America), which causes dates to be returned in dd/mm/yy format (mm/dd/yy in North America).

Now suppose you want the date to be in "day number" format dddd, the number of days since the Datataker was powered-up or reset.

Set **P31** to **0** to change the date format to dddd:

a) Type

```
P31=0
```

b) Send the line to the Datataker (**Alt L**).

c) The Datataker responds with just the echo

```
P31=0
```

d) Now check that the date format has changed by sending

```
D
```

e) The Datataker responds with something like

```
D
Day 17
```

which is "day number" format. (When a new Datataker is powered-up at the factory, or reset, its date is set to 01/01/89, which is day number 0.)

Now reset **P31** to its original value of **1**(or **2** for North America):

a) Send the line

```
P31=1
```

(or **P31=2** for North America)

b) The Datataker responds with just the echo

```
P31=1
```

(or **P31=2**)

c) Again, check the date format by sending

```
D
```

e) The Datataker responds with something like

```
D
Date 07/01/89
```

So by setting P31 to one of its three possible values you can choose the format of your Datataker's date readings.

3-6 Set the Time and Date

These are simple operations. You'll use them often when working with your Datataker.

Earlier you *read* the Datataker's date and time. Now you're going to *set* the Datataker's internal clock/calendar to particular values.

It's as easy as setting parameter values, but the important thing here is that *the formats of the new time and date you send must* ***match*** *your Datataker's time and date formats*. (If the formats don't match, the Datataker will let you know with an error message.)

So firstly, *set* the time format. Then you'll be sure of which format to use when you send the new time.

Start Time

You might not always want to set the Datataker's clock to the current time and date.

Instead, it's sometimes useful to have the time and date counting from an event. For example, if you reset the Datataker at the beginning of an experiment. — which means that the experiment started at 00:00:00 hours on day 0 — the Datataker's clock/calendar counts hours and days from that zero/starting point.

Default Time and Date

Whenever you reset your Datataker (which you do by applying power to a previously un-powered Datataker, or by sending the **RESET** command), its internal clock/calendar is set to a time of 00:00:00 hours on 1st January 1989 (01/01/89) — the default time and date.

3-6.1 Set the Time Format to HH:MM:SS

Note that this step sets the *format* of your Datataker's time.

Ensure that **P39** is set to **0**. This puts the Datataker's time into hh:mm:ss format:

a) Send **P39=0**.

b) Send **T** and verify that the time format is now hh:mm:ss.

3-6.2 Set the New Time

Now that you're certain of your Datataker's time format, you know how the new time must look when you send it (when you set new times or dates, the new information you send must match the Datataker's current format).

Set the time to, say, 3:16pm, then check the setting:

a) Send the line

```
T=15:16
```

This is the hh:mm:ss format which you set the Datataker to in the previous step (if you omit the seconds the Datataker assumes 00 — see Extras overleaf).

Note that the Datataker uses a 24-hour clock, so if you typed **T=3:16** the clock would be set to 3:16 *a.m*.

b) The Datataker echoes with

```
T=15:16
```

c) Now read the Datataker's time. Send

```
T
```

d) The Datataker responds with a slightly later time, like

```
T
Time 15:17:46
```

The actual response depends on how much time elapsed between your carrying out sub-steps a and c above.

Now set the Datataker's time to the actual/real time in your locality:

a) Repeat the procedure above, but replace **15:16** with your actual time.

The Datataker Assumes...

…00 if you omit one of hours, minutes or seconds when setting the time in the hh:mm:ss format. For example:

T=hh	sets clock to hh:00:00	(T=8 ⇨ 8:00:00)
T=:mm	sets clock to 00:mm:00	(T=:19 ⇨ 00:19:00)
T=::ss	sets the clock to 00:00:ss	(T=::22 ⇨ 00:00:22)
T=hh::ss	sets the clock to hh:00:ss	(T=10::30 ⇨ 10:00:30)

3-6.3 Set the Date Format to DD/MM/YY

This step sets the *format* of your Datataker's date so that you're certain of how to enter new dates.

Ensure that **P31** is set to **1** (or **2** for North America). This puts the Datataker's date into dd/mm/yy format (mm/dd/yy for North America).

a) Send

```
P31=1  (or =2 for North America).
```

b) Send

```
D
```

and verify that the date format is now dd/mm/yy (or mm/dd/yy for North America).

3-6.4 Set the New Date

Remember that when you set new times or dates, the new information you send must match the Datataker's current format.

Set the date to 25 December 1994, then verify the setting:

a) Send the line

```
D=25/12/94
```

(or **D=12/25/94** for North America).
This is the dd/mm/yy format (mm/dd/yy for North America) to which you set the Datataker in the previous step.

b) The Datataker echoes with

```
D=25/12/94
```

(or **D=12/25/94** for North America).

c) Now verify the Datataker's date. Send

```
D
```

d) The Datataker responds with

```
D
D=25/12/94
```

(or **D=12/25/94** for North America)

Now set the Datataker's date to today's date:

a) Repeat the procedure above, but replace **25/12/94** with today's date.

So far in this chapter, you've set the Datataker's time and date, as well as the time and date *parameters* (which control the formats). It's important to realise that you've read and set *two different things:*

- the *actual* time and date, and
- the *format* of the time and date (via parameters).

Time/Date Shortcut

You can set the Datataker's current date and time to your computer's date and time by sending the commands **T=\T** and **D=\D** from DeTerminal's lower window. But before you use these shortcuts, check that…

- the computer's date and time are correct;
- the computer's date is in the same country format as the Datataker's.

The Backslash Concept, and Datataker Commands versus DeTerminal Commands

Determinal interprets all text between the **** character (backslash) and the next space character in the line as being "for internal (DeTerminal) use only — do not transmit to Datataker."

So, for example, in the line **T=\T T**

- the two characters **T=** are part of a *Datataker* command ("set the Datataker's time");
- the three characters **\T** (backslash, **T,** space) are a *DeTerminal* command ("get the time from your computer");
- the five characters **T=\T** (**T**, **=**, backslash, **T,** space) are a complete Datataker command, which happens to include a DeTerminal command ("set the Datataker's time to the time obtained — by DeTerminal — from the computer");
- the last **T** is a simple, separate Datataker command ("get the Datataker's time").

This example has no real practical use, but it does illustrate the fact that there are Datataker commands *and* DeTerminal commands.

3-7 Practise Reading and Setting SWITCHES (/...)

Along with parameter commands, you use "switch" commands to configure your Datataker. Like parameters, they change the Datataker's internal settings. But, unlike parameters, switches only have two values — on or off.

These switches are not the physical/hardware type you set with a press of your finger. They exist in the Datataker's internal software and are set by sending commands from DeTerminal's lower window.

Each switch command consists of two characters: a forward slash (**/**) followed by a letter of the alphabet (for example, **/C**, **/f**, **/F**, **/w**). And yes, you're right — switches that you add to DOS commands also begin with the **/** character.

There's a conceptual difference between parameters and switches:

- You'll find you only set parameters once, often inserting them at the beginning of a command file (a group of command lines) to configure the Datataker for a particular logging session. Thus parameters are "set and forget".
- Switches are on/off control functions that you might want to change several times during the course of a logging session. For example, you might turn the **return data in real time** switch on (**/R**) to check that channels are being read — and then turn it off again (**/r**) — several times during a logging session. Switches are tools you can bring into use, then put away, at any time during a logging session.

When Does a Switch Take Effect?

Immediately.

From the moment you send it to the Datataker.

Upper and Lower Case

We stated earlier that "…the Datataker only responds to commands typed in UPPER CASE — with one exception."

Switches are the exception.

The state of a switch is determined by the case of its letter. Sending an upper-case switch command sets the switch on; sending a lower-case switch command sets the switch off. For example, sending **/E** turns the Datataker's echo function on, and sending **/e** turns the echo function off.

When you sent the **STATUS** command before, you saw the current settings of all your Datataker's switches. They were the last line returned in the earlier section "Send the STATUS Command". Here also, an upper-case letter means the switch is on, and a lower-case letter means the switch is off.

The Complete List

The complete list of switch commands (and parameter commands) is provided in the "Datataker Manual" supplied with each new Datataker, the "Reference Manual for the Datataker Data Loggers" available separately, and DeTerminal's **HELP** file (press the **F1** key when running DeTerminal).

Now...

Practise reading and setting a few switches.

Switch Shortcut

Sending two forward slashes (**//**, no letter) returns all switches to their default settings.

STATUS Variations

There are over a dozen variations of the **STATUS** command. For example, **STATUS9** returns just the Datataker's current switch settings, and **STATUS13** returns the time and date of the first and last readings stored in an inserted memory card. See the other Datataker manuals for a complete list.

3-7.1 Turn Echo Off (/e)

At the moment, the Datataker is echoing (to the upper window) all the commands you send from DeTerminal's lower window.

Send the **STATUS** command to check your Datataker's current switch settings:

a) Type

```
STATUS
```

then send the line (**Alt L**).

b) You'll see **/E** in the last of the lines returned, the current switch settings. The upper-case **E** means that echo is on.

Turn the echo function off (send **/e**):

a) Type

```
/e
```

Be sure to use a forward slash, a lower-case **e**, and no spaces.

b) Send the line (**Alt L**).

c) The Datataker echoes this line in the upper window — for the last time (until you reset the switch by sending **/E**).

d) Verify that echo is off by sending **T**, then **D** and observing the response (no echo) in each case.

The switch **/e** only affects the echo of your *commands*. *Data* is still returned to DeTerminal's upper window.

3-7.2 Add a Time Prefix (/T)

Currently, your Datataker's **prefix data with time** switch is off (**/t**). You'll see how turning this switch on adds the time to every scan the Datataker makes.

Observe the Datataker's current state by sending the line **4TK**:

a) Type

```
4TK
```

then send the line (**Alt L**).

As you'll learn in the next chapter, this line asks the Datataker to read channel 4 as a thermocouple. For now, we're just using it to make some fictional data appear in DeTerminal's upper window.

b) The Datataker responds with data, something like

```
4TK -3.2 Deg C
```

At the moment, your Datataker's **prefix data with time** switch is off (**/t**).

Now turn the **prefix data with time** switch on and then send the line again:

a) Type

```
/T
```

(upper-case **T**) then send the line (**Alt L**).

b) Now send the line **4TK** again.

c) The Datataker responds with something like

```
Time 00:25:45
4TK -1.6 Deg C
```

Turning this switch on has caused the time to be added to this reading and all future readings (until *you* set the switch to its other state).

3-7.3 Add a Date Prefix (/D)

Currently, your Datataker's **prefix data with date** switch is off (**/d**). You'll see how turning this switch on adds the date to every reading.

Turn the **prefix data with date** switch on, then send the line **4TK**:

a) Type

```
/D
```

(upper-case **D**) then send the line (**Alt L**).

b) Now send the line **4TK** once more. (Use the ⬆ key to highlight the **4TK** you typed previously, then press **Alt L**.)

c) The Datataker responds with something like

```
Date 01/01/89
Time 00:25:45
4TK -1.6 Deg C
```

Turning this switch on has caused the date to be added to this reading and all future readings (until *you* set the switch to its other state).

Echo Makes Errors Obvious

If you're sending many lines to the Datataker and echo is turned on (**/E**), any error message appears right under the echo of the erroneous line, making it obvious.

Error Messages – the List

There are over 60 error messages. A complete list is provided in the "Datataker Manual" supplied with each new Datataker, the "Reference Manual for the Datataker Data Loggers" available separately, and DeTerminal's **HELP** file (press the **F1** key when running DeTerminal).

3-7.4 Remove Time and Date Prefixes (/t/d)

Here you undo the two switches you just set. This is to prepare your Datataker for the next chapter by reducing the amount of information returned to DeTerminal's upper window.

Turn the two **prefix data...** switches off:

a) Send the line

```
/t/d
```

(forward slashes, lower-case **t** and **d**; spaces are optional and allowable between switches).

b) Verify the action of these switches by again sending

```
4TK
```

Have I LOST the Date and Time?

What you see in DeTerminal's upper window is everything that is being returned to your computer — no more, and no less. So if you've removed the time and date from the data returned to the upper window (as you did above using **/t** and **/d**) and you choose to save the data, all you'll save will be the bare measurements with no record of time or date.

But remember that right now you're only *scanning* a sensor. *Logging* is different. Once you set the Datataker logging, the time and date are always retrievable. This is because they are always stored automatically (in compressed form: see Extras "The Real Story — Time and Date" in chapter 1) in the Datataker *when it's logging*. Then, if you want each logged measurement's time and/or date, you command the Datataker to include these *when you unload the data to your computer*.

For simple *scanning*, you have to consciously configure the Datataker to supply the date and time with each measurement (using **/T** and **/D** is best — the NOTE at the end of section 6-6.4 explains this in detail).

3-8 If the Datataker Doesn't Understand You (Error Messages)

You can be confident that an erroneous command will never be processed by the Datataker.

If you send an incorrect command to the Datataker — for example, you try to set a parameter to a non-existent value (like **P39=7**), or turn on a non-existent switch (**/B**) — the Datataker always ignores it and responds with an error message. And when you have more than one command in a line, commands up to the erroneous one will be executed normally.

Each error message consists of an error number (**E1**, **E2**,…) and a short description of the error.

Send an incorrect line:

a) Type

```
P39=7
```

b) Send the line (**Alt L**).

c) The Datataker responds with

```
P39=7
E8-Parameter read/set error
```

Some Datataker models can be networked. If yours is one of these, the text **Datataker xx** appears ahead of the error message. This is the Datataker's Network ID number — see the Extras "Network ID".

d) That's all you have to do — there's nothing you have to "make good" after sending an incorrect line. The Datataker detected the error (7 is not one of P39's possible values) and ignored the command.

What's Next?

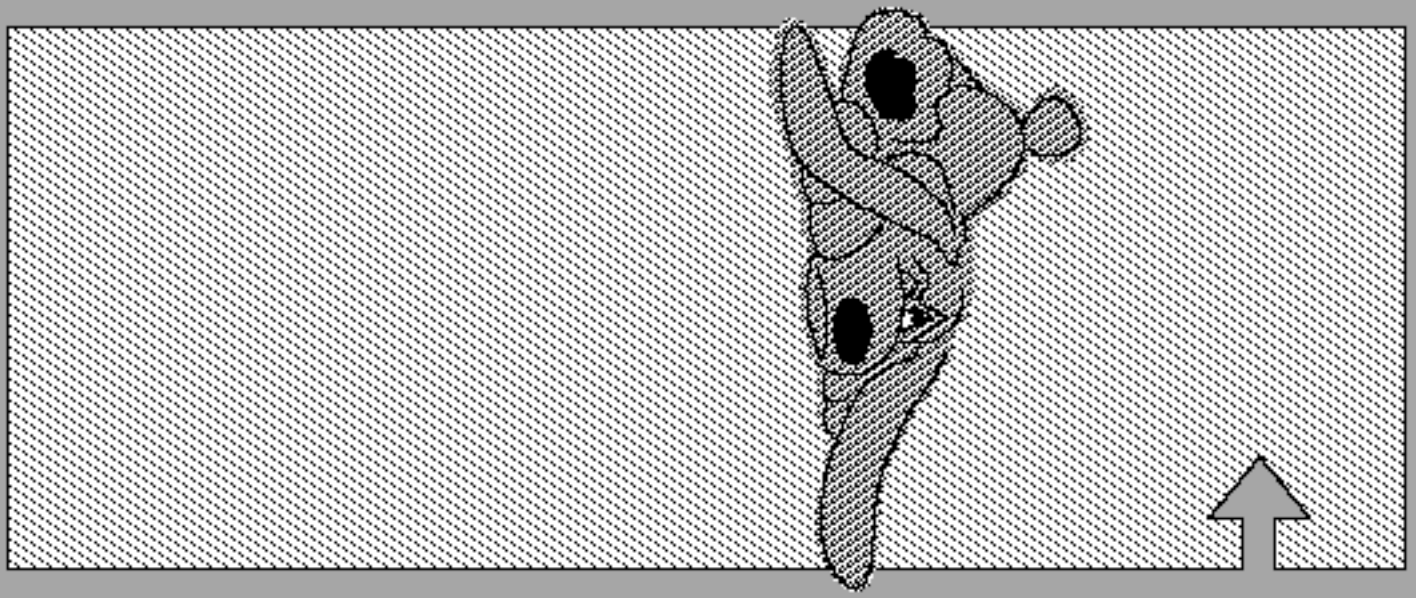
You've used the software and controlled the Datataker. Now connect a temperature sensor and make a measurement:

Go to Chapter 4 "ADD A SENSOR…"

Network ID

If you connect two or more Datataker together via their **NET** terminals (thereby forming a network), you must give each one its own Network ID number. You do this using switches — real, physical switches inside each Datataker — as explained in your "Datataker Manual" and the "Reference Manual for the Datataker Data Loggers".

Datatakers are shipped from the factory with their Network ID set to 0.



Chapter 4

Add a Sensor, Make a Measurement

Now that you can use DeTerminal to send commands to your Datataker, you're ready for data acquisition — that is, you're ready to connect a sensor to the Datataker and make a measurement.

In this chapter you learn about several important and powerful Datataker tools. You'll…

- be introduced to the concept of "channels";
- connect a thermocouple to your Datataker;
- command the Datataker to measure the temperature;
- use a "channel option" to enhance the returned data;
- use two more switches to remove unnecessary information from the returned data.

Analog Channels, Digital Channels – What's the Difference?

Analog channels are designed for information which can vary continuously through a potentially infinite number of values — for example, the time swept out by the hands of a clock or the output of a thermocouple (…, 38.1º, 38.2º, 38.3º, 38.4º, 38.5º,…).

Digital channels are designed for information which has a finite number of values. For the Datataker, computers and other electronic equipment, this number of values is two — for example, the states of a switch (on, off) or pulses from a digital counter (high, low; or 1, 0).

4-1 A New Concept: CHANNELS

"Channels" are *routes for data*, allowing information to enter and leave various parts of the Datataker.

They are locations from which the Datataker reads information (sources of data), and to which the Datataker sends information (destinations for data).

The Datataker has external and internal channels.

External Channels

External channels are the *obvious* data sources — the sets of screw terminals on the outside of the Datataker. You connect sensors to an external channel's terminals and tell the Datataker to read the channel.

"External Channels" in the Extras overleaf discusses the external analog and digital channels available on most Datataker models.

Internal Channels

Internal channels are internal sources of information. Time and date from the logger's clock/calendar, logger temperature, battery voltage, system variables and system timers are all internal channels of the Datataker.

You've already worked with some of these (time, date).

4-2 Add a Sensor

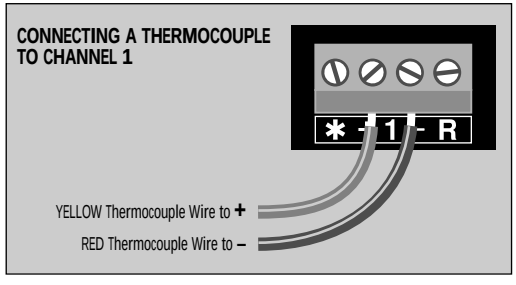
Connect a temperature sensor to one of your Datataker channels.

Connect the thermocouple (supplied with each new Datataker) to channel **1** of your Datataker:

a) Locate the K-type thermocouple temperature sensor supplied with your Datataker. It's the pair of red and yellow wires twisted and welded together at one end.

b) Locate analog channel **1** on your Datataker. It's the only set of four terminals labelled with the number **1**.

c) Connect the bared ends (not the twisted ends) of the thermocouple wires to the **+** and **–** terminals of channel **1**. (This is a "differential" connection, described in the Extra "Differential and Single-Ended Analog Input Channels" at the end of this chapter.)



To make these two connections, use the screwdriver supplied to loosen, then tighten, each terminal just as

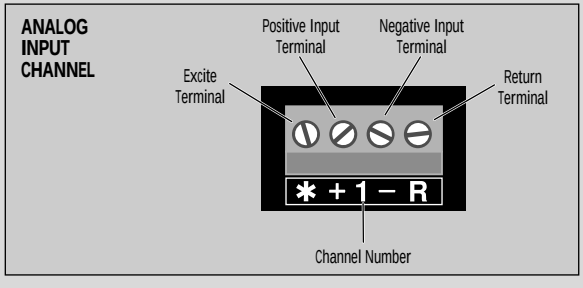
EXTRAS

External Channels

There are two types of external channels: analog and digital.

Analog Channels

Depending on the model, your Datataker has either five or ten analog channels. They are all input channels. Each has four adjacent screw terminals (labelled ✱, **+**, **–** and **R**).

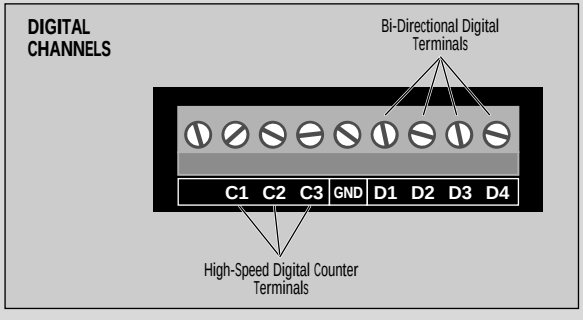


Digital Channels

In addition to the analog input channels, your Datataker has either four or five bi-directional digital channels (depending on the model), plus three high-speed digital counter channels. Each digital channel has one unique screw terminal, plus another it shares with the other digital channels.

You can use the bi-directional digital channels in three ways:

- as digital input channels (to sense events, like a door opening);
- as low-speed digital counters;
- as digital output channels (to turn on a warning indicator or control other equipment, for example).



you did in the earlier section "Connect the Mains Adaptor" — but this time, it *does* matter which wire goes into which terminal: yellow to **+**, red to **–**.

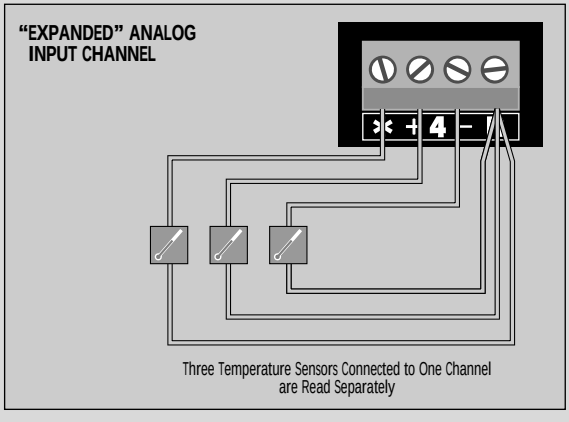
Also make sure that the two bared ends do not touch one another where they enter the terminal block — cutting the bared length back to about 6mm (¼") is ideal.

Now you're ready to make a measurement.

Expanding the Analog Channels

In general, you connect one sensor to one channel. But, depending on the type of sensor, it's possible to "expand" the analog input channels by connecting up to three sensors to each one. For example, the figure below shows three sensors connected to analog channel 4. (Note: the DT50 only supports expansion on its **+** and **–** terminals.)

This topic is discussed further in the Extra "Differential and Single-Ended Analog Input Channels" at the end of this chapter, and in the "Reference Manual for the Datataker Data Loggers".



Three Temperature Sensors Connected to One Channel are Read Separately

It's important to realise that the Datataker reads the three sensors separately, as if they are on three different channels (in the figure above, the three "channels" are called **4✱**, **4+** and **4–**).

4-3 Make a Measurement

Use your Datataker to read the temperature.

Command the Datataker to read the K-type thermocouple you just connected to channel **1**:

a) In DeTerminal's lower window, type

```
1TK
```

That's a number **1**, an upper-case **T**, an upper-case **K**, and no spaces.
1 is the "channel number" and **TK** is the "channel type" — **T** tells the Datataker to treat the device as a thermocouple, and **K** tells the Datataker the type of thermocouple.
1TK together is called the "channel ID" — see the Extras "Channel Number and Channel Type" and "Channel ID".

b) Send the line (**Alt L**).

c) The Datataker responds with a temperature reading like

```
1TK 23.7 Deg C
```

If the Datataker returns an "out of range" error message instead, see the Extras "Static Electricity".

From here on in this guide, we'll *leave out* the echo from the Datataker's response. So if you have echo turned on, you'll still see it in DeTerminal's upper window — we just won't show it in this guide.

Raise the temperature of the thermocouple and read it once more:

a) Hold the twisted ends of the thermocouple between your fingers.

b) Again, send the line

```
1TK
```

Remember, you don't have to type the line again. Use the ⬆ key to highlight the **1TK** you typed previously, then re-send the same line (**Alt L**).
The Datataker should respond with a higher temperature.
If it returns an "out of range" error message instead, see "Static Electricity" in the Extras below.

Static Electricity

If the Datataker returns an "out of range" error message, it's probably due to static charge being transferred from you to the thermocouple. This is possible because the Datataker's input circuitry is extremely sensitive, and static electricity can be surprisingly powerful.

Just let go of the thermocouple, wait a few seconds, then make the reading again.

There's no danger of static electricity damaging the Datataker or the thermocouple (although some other types of sensors *are* prone to such damage).

d) Now hold the twisted thermocouple ends firmly against the *outside* of your hot coffee mug (or above a burning match) and ask the Datataker to read the temperature once more.

Don't worry — the K-type thermocouple can measure temperatures up to 1250ºC (although the insulation may melt!) and down to –200ºC.

Channel Number and Channel Type

When making a measurement you have to give the Datataker two items of information:

1. The **channel number** — where, on the Datataker, the sensor is connected (so the Datataker knows which channel to read).
   Examples: channel **1**, channel **3**, channel **10**
2. The **channel type** — how you want the measurement at the channel's terminals to be interpreted/converted (as a voltage, as degrees Centigrade,…)
   In other words, which combination of the channel's terminals to scan, and how to process the sensor's raw output into the quantity you're interested in (refer back to "Meaningful Quantities" in chapter 1).
   There are over 30 channel types.
   Examples: **TK** means "read the channel as a Thermocouple, type K" (that is, convert its raw input to a temperature reading);
   TB means "read the channel as a Thermocouple, type B" (that is, convert its raw input to a temperature reading);
   V means "read the channel as a Voltage" (that is, convert its raw input to a voltage reading).

This might appear complicated, but in practice it's simple. As an example, once you've connected the two thermocouple wires to the correct two terminals of, say, channel **4**, you simply send the line **4TK**. The Datataker responds with the current temperature.

Channel ID

The "channel ID" (**1TK** in the exercise above) is the channel number (**1**) followed by the channel type (**TK**).

The channel ID is all you send to the Datataker to get it to scan a channel and return the measurement to DeTerminal's upper window.

4-4 Add User-Friendliness to the Returned Data (CHANNEL OPTIONS)

In the previous steps, the Datataker response contained a lot of information — the channel ID (channel number and type), the measurement, and the units of measurement.

There will be times when you'll want to make the returned data more user-friendly. Here's how:

Personalise your Datataker's response by using the **replace channel ID with text** channel option to add the words "Room Temperature":

a) Type

```
1TK("Room Temperature")
```

(no spaces, except inside the quotation marks).

Note that there's a limit of 16 characters for this particular channel option — that is, no more than 16 characters inside the quotation marks.

b) Send the line (**Alt L**).

c) The Datataker responds with

```
Room Temperature 23.2 Deg C
```

which is a more meaningful and useful presentation of your data.

RECOMMENDATION We recommend you use this channel option, **replace channel ID with text**, to simplify and clarify your data collection whenever possible.

There are many other channel options available — see the Extras below.

Channel Options

You can add "channel options" to tailor the data returned by your Datataker.

There are approximately 50 channel options. You'll find them listed in your "Datataker Manual" or the "Reference Manual for the Datataker Data Loggers".

Channel options allow you to format the returned data in a variety of ways; set signal amplification and attenuation; terminate and unterminate input terminals; reset counter channels; apply scaling, polynomials or span limits; calculate the difference, the rate of change, and integrate between readings; calculate averages, standard deviations, maxima and minima; and so on.

Channel options are enclosed in brackets immediately after the channel ID (no space). You can apply more than one channel option to a particular channel — just separate them by a comma (with no spaces). This is explained in detail in the Datataker manuals.

Channel Type ≠ Sensor

The channel type you specify does *not* have to be the same as the sensor you connect to it.

For example, you can connect an RTD (normally a temperature sensor) but have it read as a resistance, or connect a thermocouple and have it read as a voltage source.

4-5 Be Economical (More Switches)

You've just modified the Datataker's output using a channel option. Here are two more ways to configure the output to suit your needs, using switches this time.

Here, you'll reduce the information coming from the Datataker to a bare minimum by removing the units (**Deg C**) and the channel ID (**1TK**), leaving only the measured value. In practice, you might do this when you're collecting a vast amount of data and, for storage reasons, you want to keep this to a minimum; or when you're simply collecting information for analysis by computer — you can command the Datataker to format the data ready to be imported into a spreadsheet (the Datataker provides you with rows of readings, each reading separated by a comma and each row separated by a carriage return and a line feed character).

Remove the units of measurement (**Deg C**) from the information returned by the Datataker using the **units** switch):

a) Type

```
/u
```

(forward slash, lower-case **u**, no spaces).

b) Send the line to the Datataker (**Alt L**).
The units switch is now off.

c) Read the temperature again by sending

```
1TK
```

d) The Datataker responds with

```
1TK 23.1
```

which is just the channel ID and the measurement.

Now remove the channel ID from the information returned by turning off the **channel number** switch:

a) Type

```
/n
```

(forward slash, lower-case **n**, no spaces).

b) Send the line to the Datataker (**Alt L**).

c) Read the temperature again by sending

```
1TK
```

d) The Datataker responds with

```
23.1
```

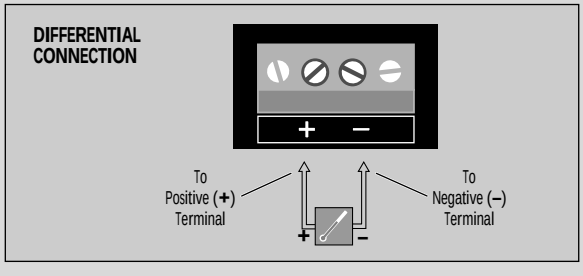
which is just the bare measurement.
For many applications this could be all you need.

Differential and Single-Ended Analog Input Channels

Your Datataker can measure a sensor's output in either of two basic modes — "differential" mode (also called "double-ended" mode), and "single-ended" mode.

Differential Mode

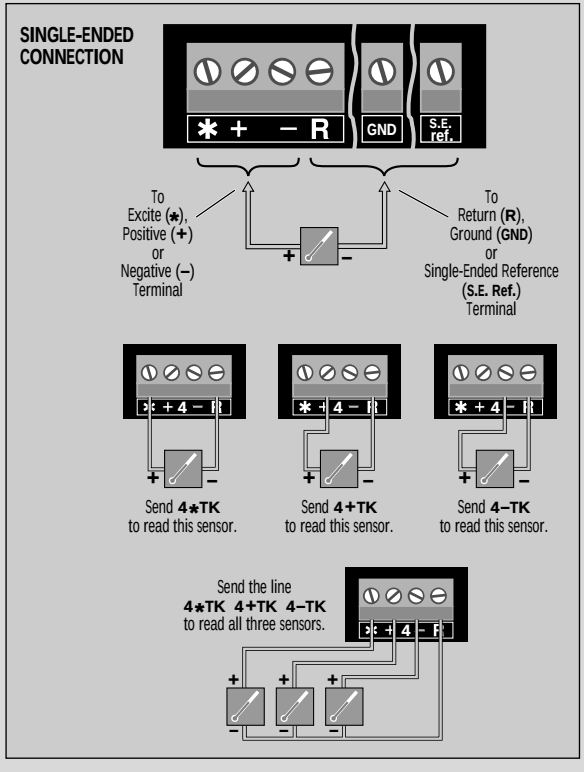
Earlier in this chapter, when you connected the thermocouple to channel 1 and sent the line **1TK** to read the temperature, you used the differential mode. You connected the sensor to the **+** and **–** terminals (this is the "differential connection"), and you commanded the Datataker to "read channel 1 differentially" (sending **1TK** causes the Datataker to do this, by measuring the *difference* between the signals on the **+** and **–** terminals).



Single-Ended Mode

If you need to connect more than one sensor to a channel (see the Extras "Expanding the Analog Channels" earlier in this chapter), you must use the single-ended mode, as follows:

1. You connect the sensor's positive side to the channel's ✱, **+** or **–** terminal.
2. You connect the sensor's negative terminal to one of the Datataker's reference terminals (Return **R**, Ground **GND**, or Single-Ended Reference **S.E. Ref.**).
3. You refer to the channel according to which of the ✱, **+** or **–** terminals the sensor's positive side is connected.
   For example, you read a single-ended thermocouple connected to channel 4 by sending either **4✱TK**, **4+TK**, or **4–TK**. And if you're using the **S.E. Ref.** terminal, add the three-character suffix **(X)** to each of these lines.



As shown above, the single-ended mode allows you to read up to three sensors *at the same time* on any or all of your Datataker's analog channels. (Exception: the Datataker 50 does not support single-ended measurement via the ✱ terminal.)

RECOMMENDATION We recommend you always use the differential mode unless you need to connect more than one sensor per channel, in which case you must use the single-ended mode.

Note that, depending on your implementation, single-ended operation *could* result in some decrease in accuracy due to ground-loop noise. This possible problem, and its remedy, is discussed in "The Analog Input Channels" in the "Reference Manual for the Datataker Data Loggers".

RESET your Datataker in preparation for the next chapter:

a) Type

```
RESET
```

and send the line.

This resets the Datataker's clock to 01/01/89 and 00:00:00, and returns its switches and parameters to their default settings.

Beware!

Your Datataker does everything possible to avoid data loss caused by careless use.

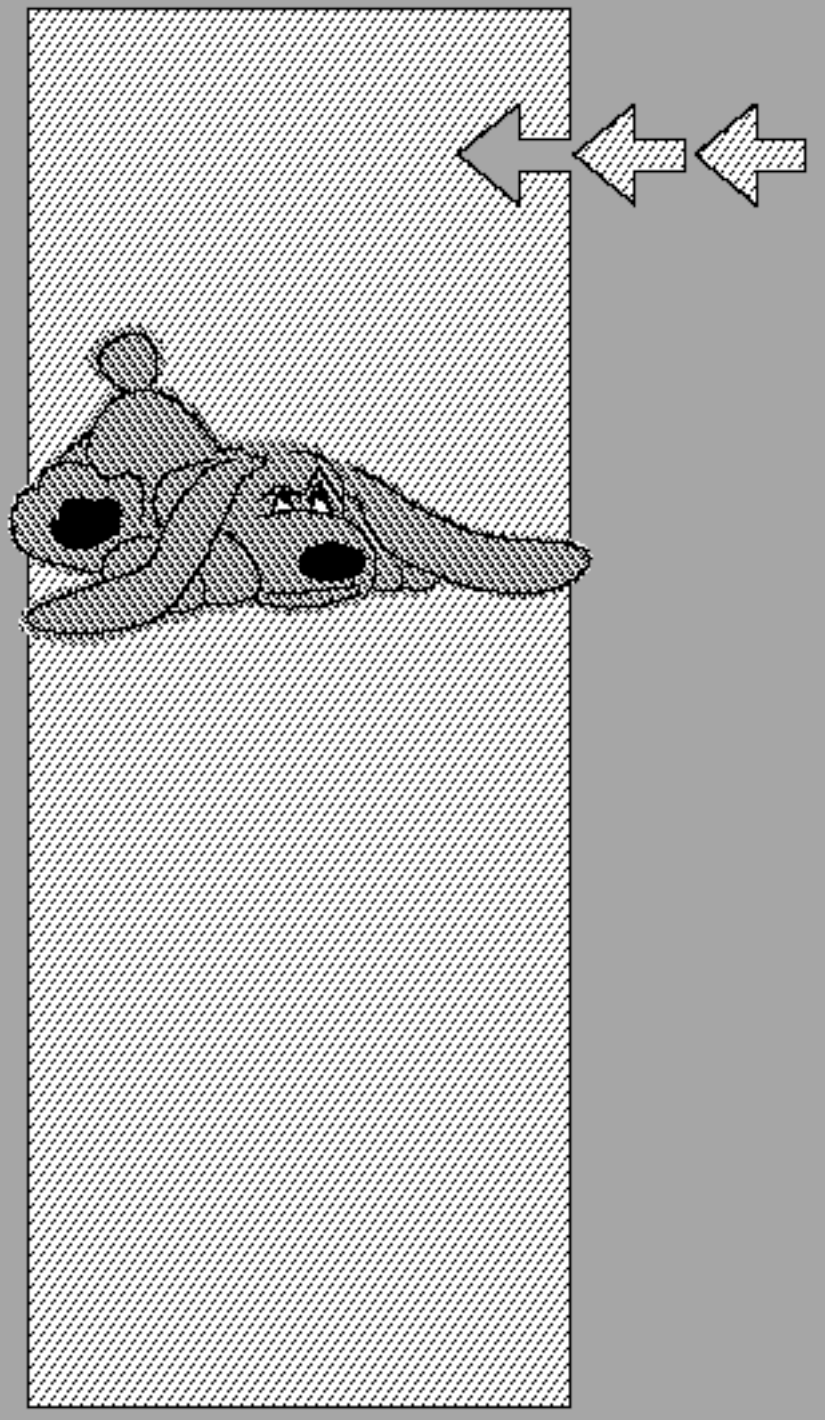
However, it responds to the **RESET**, **CLEAR**, **CLAST**, **CSCANS**, **CALARMS**, **CDATA** and **CPROG** commands *without question*, so take care with these (the Extras "Summary: Clear Commands" in chapter 6 describes these commands).

What's Next?

So far, you've used the software, controlled the Datataker and read a temperature sensor. Next, you learn how to make the Datataker take a *series* of readings automatically:

Remember that you're not logging data yet — you've just read a sensor and had the readings returned to the upper window of DeTerminal software running on a computer connected to your Datataker (data acquisition only).

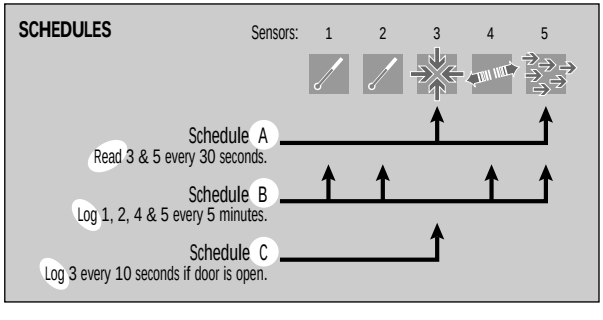
Go to Chapter 5 "REPEAT…"



Chapter 5

Repeat the Measurement

In this chapter you start doing some real work with your Datataker — you set it scanning, then sit back and watch the data roll in.


SCHEDULES
Sensors: 1 2 3 4 5
Schedule A
Read 3 & 5 every 30 seconds.
Schedule B
Log 1, 2, 4 & 5 every 5 minutes.
Schedule C
Log 3 every 10 seconds if door is open.

5-1 Another New Concept: SCHEDULES

So far, you've just made one-at-a-time, separate measurements. Now you're going to automate the process, getting the Datataker to make a series of readings at regular intervals.

Schedule Command

You'll do this by sending a command to the Datataker which tells it what to do, when (or under what conditions) to do it, and which channel(s) to do it to. The Datataker processes this command and creates a "schedule", which is simply *a sequence of operations* that the Datataker remembers in order to carry out your instructions. Because this command specifies a sequence of operations, it's called a "schedule command".

A schedule command is very powerful, but quite simple — it's just a *list of operations* for the Datataker to do. And you can tell the Datataker to do them *once*, or *regularly and repetitively*, or either of these *when certain conditions exist*.

As the adjacent figure "Schedules" shows…

- you can include any sensor in any schedule command;
- you can include many sensors in one schedule command — so that they are read according to the same time interval, event, or condition;
- you can include a sensor in more than one schedule command — so that it is read according to more than one time interval, event, or condition;
- you can write schedule commands that just *read* sensors (used, for example, to monitor for over-range conditions), or read *and log* sensors, or some that cause the Datataker to create *more than one* schedule (for example, a repeat schedule command (explained overleaf) which contains a statistical option causes a repeat schedule *and* a statistical schedule to be created).

Schedule commands will be your most-often-used tool when working with your Datataker.

There are four basic *types* of schedules — immediate, repeat, statistical and alarm.

5-1.1 Immediate Schedule

Without knowing it, this is what you've been using so far in this User's Guide. When you made your first measurement by sending **1TK** to the Datataker, **1TK** was an "immediate schedule" command. You sent the line, and the Datataker carried out the sequence of operations straight-away, once only. (Although schedule commands can contain one or many operations, in this particular case the command **1TK** created a schedule of just one operation.)

Think of immediate schedules as being "single-shot" or "once-only" schedules.

The Datataker can only process one immediate schedule at a time. That's why we say that the Datataker has only *one* immediate schedule. (In practice, you can send many immediate schedules if you wish — the Datataker simply queues them up and processes them one-at-a-time.)

Note that you can use a particular immediate schedule more than once — you just have to re-send it each time (and there's a shortcut for this: sending the ✱ character causes your last immediate schedule command to be repeated).

5-1.2 Repeat Schedules (R...)

These are what this chapter is mainly about.

Here are two examples of "repeat schedule" commands:

```
RA2S 1TK
```

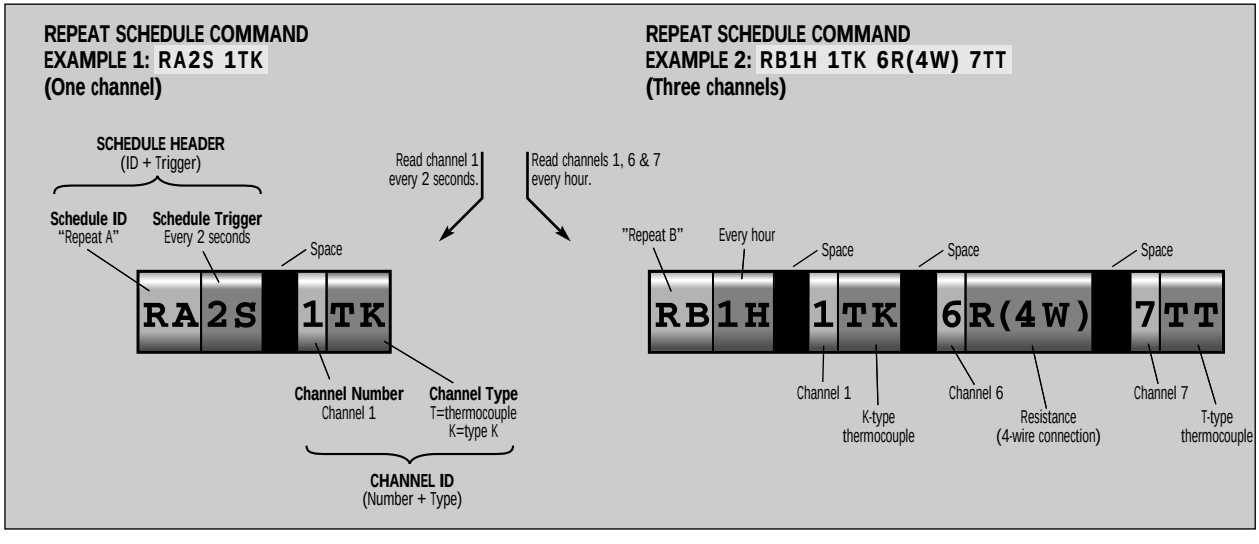
(*name:* Repeat schedule A; *when:* every 2 Seconds; *channel:* 1)
and

```
RB1H 1TK 6R(4W) 7TT
```

(*name:* Repeat schedule B; *when:* every 1 Hour; *channels:* 1, 6 , 7).

They are explained in detail in the figure below. If you examine the figure you'll see that a repeat schedule command is nothing more than a list containing the following information:

- A name for the schedule that the Datataker will create — the "schedule ID" (examples: **RA**, **RB**, **RC**, **RD**). The prefix **R** is how the Datataker recognises a repeat schedule. Think of the **R** as standing for "repeat", "report" or "return".
- When, or how often, to take readings — the schedule's "trigger". This can be either *regular* time intervals (for example, every 5 seconds, every hour, once a week), or *irregular* time intervals (for example, every time a certain event or condition occurs, like a switch closing or the Datataker detecting an alarm condition).



- The channel ID(s) — which you now know to be immediate schedule commands when used alone (**1TK**, for example). You'll remember that these are comprised of the numbers of the channels to be read (**1**, for example) followed by the channel types (how to read each channel — **TK**, K-type thermocouple, for example).

Operations, Channel Table

Your Datataker can perform a multitude of "operations" for you, like reading a particular channel or counter, reading the date, reading the time, checking a particular alarm, or calculating the difference between the latest reading and the previous reading for a particular channel. Each of these is an individual operation your Datataker carries out according to a trigger. For example, the second repeat schedule (**RB**) on the previous page is comprised of three operations — "read channel 1 as a K-type thermocouple every hour", "read channel 6 as a 4-wire resistance every hour", and "read channel 7 as a T-type thermocouple every hour".

The Datataker stores these operations in its "channel table", part of its internal memory, and the important thing to know is that *each operation takes up one row of the channel table*. So, although the second repeat schedule (**RB**) on the previous page is just *one schedule*, its operations take up *three rows* of the Datataker's channel table.

Finally, here's the point: the channel table's capacity is not infinite — it has a limit of 110 rows, which means you're limited to 110 *operations* per Datataker. (In practice, we've found that our users rarely need more than 110 operations. But if you do, it's a simple matter to add another Datataker.)

CHANNEL TABLE (Each row is one "operation".)

ROW	CHANNEL No.	CHANNEL TYPE	SCHEDULE	TRIGGER	
1	1	TK	RA	2s	← Example 1
2	1	TK	RB	1h	← Example 2
3	6	R(4W)	RB	1h	
4	7	TT	RB	1h	
5					
↓ Maximum 110 rows					

In the figure, note that each and every occurrence of a particular operation appears separately (in its own row) in the channel table. For example, **1TK** occurs twice (because of different triggers) and therefore takes up two rows.

Schedules – The Big Picture

The schedules at your disposal are…

- An immediate schedule, used for acquiring data (example: **1TK**). You can send as many of these "single-shot" schedules as you wish (up to the limit of 110 *operations* — total for *all* schedules, as described in "Operations, Channel Table" above), but the Datataker only processes them one-at-a-time (the others queue for service).
- Five repeat schedules, used for acquiring and logging data:
  - **RA**, **RB**, **RC** and **RD** — four general-purpose repeat schedules, triggered by time interval or an event (example: **RA2S 1TK**);
  - **RX** — one "polled" schedule, triggered by an **X** character sent from a computer (discussed in the Datataker manuals).
- One statistical schedule (discussed in the Datataker manuals).
- One alarm schedule, which can include many alarm descriptions (discussed at the end of this chapter and in the Datataker manuals).

Priority

Alarm schedules are given top priority, then repeat schedules (including statistical sub-schedules), then immediate schedules.

For example, if you send an immediate schedule at the same moment a repeat schedule is due, the Datataker services the repeat schedule first and the immediate schedule a few tens of milliseconds later.

5-1.3 Statistical Schedule

When you want to produce a statistical summary (that is, the average, standard deviation, minimum, maximum, integral, or histogram) of a group of data, you incorporate a statistical channel option into a repeat schedule command.

When you send this to the Datataker, it creates a "statistical schedule", which controls the sampling of channels for which you have included statistical channel options. Put another way, the Datataker constructs this statistical schedule (there is only one) from information you include in your repeat schedule commands. This is why it's sometimes called a "sub-" schedule: because the statistical schedule is created from your repeat schedules.

The default setting is for the statistical schedule to scan as often as possible when the Datataker is not servicing other schedules. You can alter this by sending the statistical schedule command **RS...** (see the Datataker manuals for details) if you wish the statistical schedule to be triggered on specific time intervals or by particular events.

Statistical sub-schedules are not covered in this guide, so if you want information about them see your "Datataker Manual" or the "Reference Manual for the Datataker Data Loggers". And in the section "The Power of Schedules" near the end of this chapter you'll use a statistical schedule command.

5-1.4 Alarm Schedule

Alarms are discussed in more detail at the end of this chapter. So for now, you should simply know that this type of schedule is used to warn you of out-of-range conditions and, optionally, to control the Datataker's operation whenever the alarm condition exists.

Although alarm schedule commands are extremely powerful tools, they are still just simple lists from which the Datataker creates its one-and-only "alarm schedule".

Like repeat schedule commands, alarm schedule commands begin with a schedule ID. Here's an example which puts the text **Clear the building** on your computer's screen when the temperature measured by the K-type thermocouple on channel 1 exceeds 40º:

```
ALARM1(1TK>40)"Clear the building"
```

(The schedule ID is **ALARM1**.)

To improve readability, you can use the keyword **IF** in place of **ALARM**, so that

```
IF2(T>12:30:00)"LUNCH TIME"
```

is also a valid alarm schedule command.

Alarm schedules can not log data directly, but they can trigger other schedules which *do* control logging. For example, you could send an alarm command to start a repeat schedule **RC** whenever a coldroom door opens and stop **RC** 2 minutes after the door closes each time (**RC** logs the coldroom temperature every 10 seconds).

The default setting is for the alarm schedule to scan continuously at the maximum scan rate possible. You can alter this by sending the alarm schedule command **RZ...** (see the Datataker manuals for details) if you wish the alarm schedule to be triggered on specific time intervals or by particular events.

5-2 Your First Schedule

This is the moment you've been waiting for — making the Datataker *repeat* measurements.

Command the Datataker to read the thermocouple on channel 1 every two seconds:

a) Type

```
RA2S 1TK
```

(all upper-case letters, with a space after **S**).

b) Send the line (**ALT L**).

c) Watch DeTerminal's upper window. Every two seconds you'll see a new reading.

d) Squeeze the end of the thermocouple (the twisted bared wires) between your fingers and observe the measurements returned.

Speed-up the rate to once every second:

a) Send

```
RA1S 1TK
```

Slow the rate to once every 5 seconds:

a) Send

```
RA5S 1TK
```

Congratulations. You've just commanded your Datataker to make repeated measurements at regular intervals. This is the foundation of data logging.

Quick-Change

You can quickly change the scan rate for a schedule that's currently running on the Datataker *without re-entering the channel IDs*. You just send the new schedule header — the schedule ID and the new trigger — without the channel ID(s).

So to change the **RA** schedule above so that it reads every 30 seconds instead of its existing rate, simply send

```
RA30S
```

Synchro-Switch

In the last schedule above (**RA5S 1TK**), notice that the Datataker is taking readings *on the minute* and at 5-second intervals thereafter.

This is another setting you can change with a switch — the **synchronise** switch: **/S**, the default setting, turns synchronisation on (all schedules' time intervals are synchronised to midnight); **/s** turns synchronisation off (schedules run from the moment of entry).

5-3 Include a Time Stamp

At the moment, your Datataker is running a schedule (**RA5S 1TK**) and sending temperature measurements to DeTerminal's upper window.

Imagine you want to see how the temperature rose and fell over the period of a day. Having just a stream of temperature figures might not be much use because there's nothing in the data to indicate the time of day… yet.

Include the time of each reading in the schedule:

a) Send

```
RA2S T 1TK
```

(there's a space either side of the middle **T**).

b) Look at the returned information. Now every reading carries a "time stamp".

c) Now send

```
RA2S 1TK T
```

(swap the positions of **T** and **1TK**).

d) Verify that the order of the returned information is reversed.

5-4 Halt, Go

You have a schedule running, but let's say you want to stop it while you reposition the sensor, then continue with it again.

Halt the **A** schedule:

a) Send

```
HA
```

(that's an **H** for Halt and an **A** for the schedule name, no spaces).

b) Look at DeTerminal's upper window.
The Datataker has stopped returning information because you've halted the schedule.

Now you've repositioned the sensor. Re-start the **A** schedule:

a) Send

```
GA
```

(that's a **G** for Go and an **A** for the schedule name, no spaces).

b) Look at DeTerminal's upper window.
The schedule is running again exactly as before.

5-5 Add Another "Sensor"

In this section you'll connect a variable resistance (a "potentiometer") to a channel of the Datataker and use it to simulate a sensor.

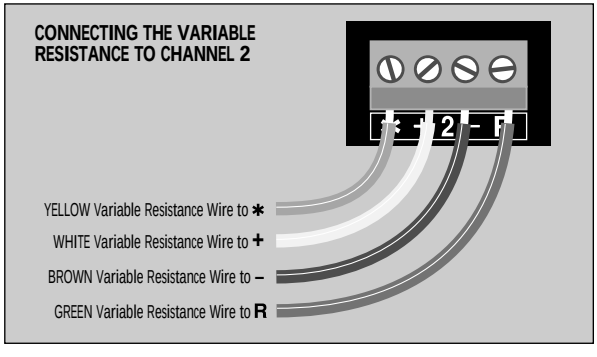
The variable resistance is mounted inside the brightly-coloured children's building blocks supplied with your Datataker.

This simulation is quite realistic because there are many types of sensors which operate just like a variable resistance. The quantity you want to measure (temperature, pressure, light intensity,…) causes the sensor's resistance to change, just like turning the knob on the variable resistance.

5-5.1 Measure Resistance

Now you add a second sensor to the Datataker and read it in two different ways.

Connect the variable resistance's four wires to the screw terminals of your Datataker's analog input channel 2. Be sure to connect the yellow wire to the ✱ terminal, the white wire to the **+** terminal, and so on as shown in the figure below:


CONNECTING THE VARIABLE RESISTANCE TO CHANNEL 2
✱ + 2 – R
YELLOW Variable Resistance Wire to ✱
WHITE Variable Resistance Wire to +
BROWN Variable Resistance Wire to –
GREEN Variable Resistance Wire to R

Now send a new **A** schedule to command the Datataker to read the variable resistance every second:

a) Send

```
RA1S 2R(4W)
```

RA is the schedule ID, **1S** is the schedule trigger (every 1 second), **2R** means "read channel 2 as a resistance", and the channel option **4W** is explained in the Extras "4W Channel Option" overleaf.

A new schedule automatically replaces any previous schedules running on the Datataker. So when you send this new schedule, the logger stops sending temperature measurements from channel 1 and starts sending resistance measurements from channel 2.

"Ohms" are the units of resistance.

b) Watch the readings in DeTerminal's upper window as you slowly turn the knob on the variable resistance.

c) Set the reading as close to 100 ohms as you can. From now on, leave the knob in this position until you're instructed to change it (in the next section).

5-5.2 Measure Resistance and Temperature

So far, you've commanded the Datataker to read the variable resistance as a resistance.

Now you're going to let the Datataker think the variable resistance is a temperature sensor. (If this concept — tricking your Datataker — concerns you, read "Measuring Resistance, and More " in the Extras overleaf.)

And, as well as reading the variable resistance's channel as a resistance, you'll tell the Datataker that the sensor is a platinum resistance temperature detector (a platinum RTD), whose resistance changes with temperature.

Send a new **A** schedule to command the Datataker to read the variable resistance on channel 2 every three seconds, but according to *two* channel IDs — one to read the channel as a resistance (**2R**), the other to read the channel as a platinum RTD (**2PT385**):

a) Send

```
RA3S 2R(4W) 2PT385(4W)
```

Be sure to type a space ahead of each channel ID.

b) The Datataker now returns two values each time it measures channel 2: a resistance (ohms) and a temperature (°C).
If you've moved the knob since the previous step where you set the resistance reading to approximately 100 ohms, return it to that setting now.

Slowly increase the resistance until the Datataker return an error message:

a) Slowly turn the knob on the variable resistance clockwise. Stop when the Datataker returns an error message

```
…Exx-linearization error(s)
```

This has occurred because you've made the resistance too large to represent an RTD. Notice also that the temperature reading is now all **9**s. This is the Datataker's way of telling you that something is wrong with the measurement.
Clever Datataker.

4W Channel Option

The **4W** you send to the logger in this section is another channel option. It tells the Datataker to measure the potentiometer's resistance by the "4-wire method" rather than by the default "3-wire method" (which is less accurate, but more common).

These measurement methods are described in the "Datataker Manual" supplied with each new Datataker, or the "Reference Manual for the Datataker Data Loggers" available separately.

Measuring Resistance, and More

The Datataker measures resistance indirectly. It sends a constant, fixed, known current through the resistance and measures the voltage this causes across the resistance. The Datataker then converts this voltage into the actual quantity you want to measure.

So in measuring, say, the temperature inside an oven using a resistance-type temperature sensor inserted through the oven wall and connected to a Datataker channel, the following happens:

- the oven temperature determines the sensor's resistance;
- the sensor's resistance determines the voltage at the Datataker's terminals;
- the Datataker converts this voltage to the quantity you're really interested in — temperature.

This last step, the conversion from voltage to temperature, is why you must include the sensor/channel *type* in schedules. It tells the Datataker "how to read the channel" — that is, which of the many conversion tables (stored in the Datataker) to apply.

In other words, the Datataker doesn't automatically detect which sensor types you connect. You have to tell the Datataker — this is the purpose of the channel type in schedules.

This means you can trick the Datataker by asking it to read a particular sensor as a totally different type, which can be useful sometimes. It also means you have to be careful when specifying channel IDs — you must pair the channel number and the channel type correctly.

5-6 The Power of Schedules

Let's say you now want to do things at three different time intervals — three different triggers.

If you'd wanted all the measurements to be made at the same time interval, you could have included them in one schedule (as you did in the previous section). But because there are three different time intervals, you use three schedules.

Check that you still have the thermocouple connected to channel 1 and the variable resistance connected to channel 2.

Send schedules to the Datataker to…

- read the variable resistance (channel 2) every second;
- read the temperature (channel 1) every five seconds;
- include a time stamp every ten seconds:

a) Send the line

```
RA1S 2R(4W) RB5S 1TK RC10S T
```

which is comprised of the three repeat schedules **A**, **B** and **C**. In order to send all three schedules you must type them on one single line (until you learn how to create a command file, which is covered in the next chapter).

b) Observe DeTerminal's upper window to verify that the Datataker is returning resistance values every second, temperature values every five seconds, and time every 10 seconds.

Send the statistical schedule command **RA2S 1TK(AV)**. This causes the Datataker to calculate and report (every two seconds) a running average of the temperature measurements made (as rapidly as possible) on channel 1 since you sent the line.

That is, the Datataker scans channel 1 as often as possible (the *default* statistical schedule trigger) and, every two seconds, calculates and reports the average of all these readings.

5-7 Alarms

Your Datataker can compare the data it measures against values you define and warn you, and/or take action, if a limit is exceeded or a particular condition occurs.

You do this with "alarm" schedule commands, from which the Datataker creates a single alarm schedule to monitor the required channels.

You can test any or all data being measured by the Datataker, from data received on its external channels (the analog and digital external terminals) to data generated internally (time, date, internal temperature,…).

Comparisons

The data from these sources can be compared against one, or two, setpoints which you define. There are four possible types of comparisons:

- low alarm (value is less than the setpoint)
- high alarm (value is greater than the setpoint)
- in-range alarm (value is between two setpoints)
- out-of-range alarm (value is outside the range of two setpoints).

(There is no test for " value equals setpoint" because such equality is only a brief state, if it occurs at all.)

Action

When the Datataker detects an alarm condition it can…

- display a pre-defined message on the host computer's screen (and on the Datataker's display, if one is fitted);
- switch its digital output channels (to activate an external warning device, for example), or switch the warning indicators, beeper or the backlight of the panel-mount display (if your Datataker is fitted with any of these);
- automatically execute a pre-defined command or sequence — that is, the Datataker can automatically "re-program" itself to operate differently when an alarm occurs.

These actions can be performed immediately the Datataker detects an alarm condition, or after a user-defined time delay (which is useful when you want the logger to ignore short-term nuisance alarm conditions).

Logical Combinations

You can link several alarm commands together using the logical operators AND, OR and XOR. This allows you to monitor complex conditions involving more than one channel or data source.

Here are some basic alarms using the thermocouple connected to channel 1 of your Datataker:

Firstly, alter the current schedule so that it reads the thermocouple once a second, instead of every two seconds:

a) Type

```
RA1S 1TK
```

b) Send the line (**ALT L**).

This new **RA** schedule automatically replaces the previous **RA** schedule, and the temperature is returned to DeTerminal's upper window once every second.

Now send a high-temperature alarm command to the Datataker:

a) Type

```
ALARM1(1TK>30)"WARNING: REDLINE  "
```

which sets an alarm to show the words **WARNING: REDLINE** in DeTerminal's upper window when the temperature **1TK** exceeds 30º.

Be sure to include the number **1** after **ALARM** (alarms must be numbered), and only use spaces inside the quotation marks (the message). We have included the two spaces after **REDLINE** to separate the alarm message from the returned data, as you'll see next.

b) Send the line (**ALT L**).
This alarm schedule is now monitoring channel 1 at its default rate (25 times per second).

c) Watch the information appearing in DeTerminal's upper window as you squeeze the tip of the thermocouple between your fingers.
Verify that when the temperature rises above 30º, the **WARNING: REDLINE** alarm message appears.

d) Remove your fingers so that the temperature drops to below 30º then repeat step c above.
Notice that the message appears only once.

Next, send an alarm which warns you not just once, but for as long as the temperature is above 30º:

a) Type

```
ALARMR2(1TK>30)"HOT   "
```

Note the **R** (for Repeat) after **ALARM**, and the number **2** after **R**.

b) Send the line (**ALT L**).
There are now two alarms running: **ALARM1** and **ALARMR2**.

c) Again, raise the temperature of the thermocouple.
Verify that the message **HOT** appears for as long as the temperature is above 30º.

Here's one more:

a) Send

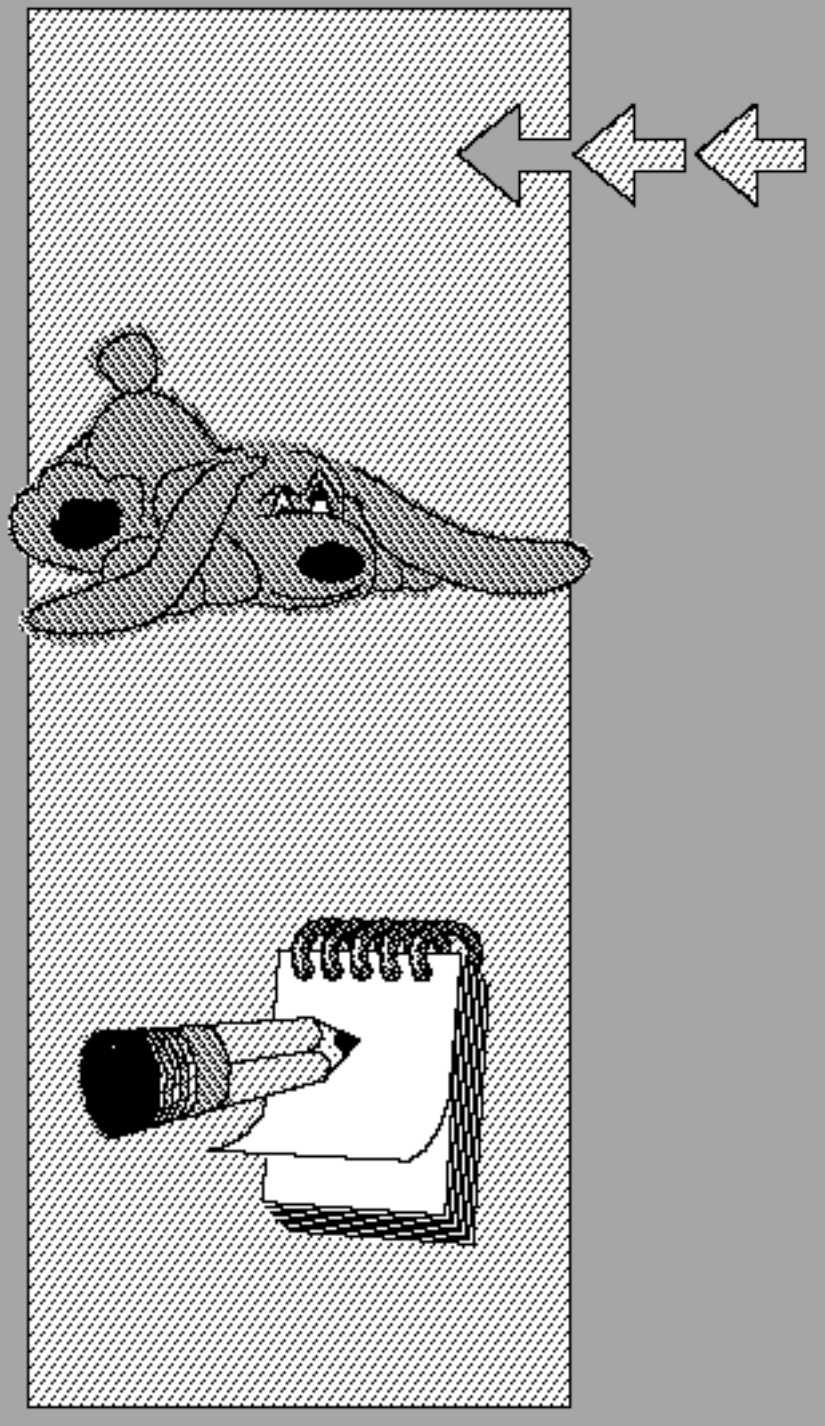
```
ALARMR3(1TK<30)"TEMP OK "
```

b) Warm and cool the thermocouple either side of 30º and confirm that the appropriate alarm message appears.

What's Next?

Logging, at last.

Go to Chapter 6 "LOG…"



Chapter 6

Log the Measurements

This is the final chapter.

Once you know how to log data using the Datataker, you'll have covered all of the Datataker's basic features and be ready to set up your own data acquisition and logging sessions.

So far, you've commanded the Datataker to scan sensors, make measurements, and send the data to your computer — data *acquisition*. You haven't *logged* (recorded) any of the data… until now.

Of course, if you're happy to keep a computer connected to your Datataker for the duration of your logging session (which could be days, weeks or months), you can create a log of the data by saving the information returned to DeTerminal's upper window (as a computer file) or by printing it out.

But in many data acquisition/logging applications, Datataker owners prefer to use their Datataker to its full capability by making it log data to its own internal memory (or to an external memory card if present). Then the logged data is available for periodic bulk transfer to a computer for analysis and long-term storage, and the computer is freed for other tasks.

In this chapter you'll start a logging session, log a few minutes' data, stop the logging session, then transfer the data back to the computer.

6-1 Prepare Your Datataker

There are three things to do in preparation for this logging exercise: **RESET** your Datataker, send a schedule to start the logger taking readings, and turn off the return of data to DeTerminal's upper window.

Firstly, **RESET** your Datataker to ensure it operates as described in this chapter:

a) Send

```
RESET
```

b) Wait for the Datataker to return the line

```
Initializing...Done.
```

before going to the next step.

Secondly, schedule the Datataker to scan the variable resistance every second:

a) Send the line

```
RA1S 2R(4W)
```

The Datataker is now measuring the resistance once a second and returning the values to your computer.

Thirdly, use the **return data** switch (**/r**) to stop the Datataker returning data to the computer (explained in "$SESSION Files" in the Extras below):

a) Send the line

```
/r
```

(forward slash, lower-case **r** , no spaces).

b) Watch DeTerminal's upper window to verify that the information flow has stopped.

Now the Datataker is only *measuring* — it's not returning data any more, and you haven't yet started it logging.

Assure yourself that all's well by watching the **Sample**, **Convert** or **Converting** indicator on the outside of your Datataker. It will be flashing every second (each time the logger makes a measurement). This is one way you can verify that the Datataker is doing something.

RECOMMENDATION Another way is to send the **STATUS** command as you did in "Practise Sending Commands to the Datataker" in chapter 3. *We recommend that you get into the habit of using* **STATUS** *when working with your Datataker*. See the Extras "STATUS Variations" in chapter 3.

"Return" Switches

Yes, you're right: **/e** stops the return (echo) of *commands*, and **/r** stops the return of *data*.

$SESSION Files

While you work, DeTerminal automatically stores the information you type in its lower window (commands and comments) and everything that is returned to the upper window (data, and echoes of commands and comments) to spaces called "buffers" *temporarily* created on your computer's hard disk. Then when you exit DeTerminal, this information is permanently saved — automatically:

Upper Window: $SESSION.DAT

When you exit DeTerminal, all the information in DeTerminal's upper window — that is, in the "receive buffer" — is saved to a file called **$SESSION.DAT** in your **determ** directory on the hard disk. This file stores up to 2MB of returned data automatically (2MB is the default size — see DeTerminal's **HELP** file if you want to change this maximum size). And when you exit DeTerminal correctly, this new file *replaces* $SESSION.DAT from the previous session.

Lower Window: $SESSION.COM

Similarly, the contents of DeTerminal's *lower* window — the "transmit buffer" — are saved to a file called **$SESSION.COM**. When you exit DeTerminal correctly, this new $SESSION.COM file *replaces* the one from the previous session.

Lifesaver

Therefore, at any time during a data logging/acquisition session, you can load the previous session's $SESSION.DAT or $SESSION.COM file into DeTerminal's lower window (using the **Open** command, **Alt O**). This way, you can retrieve the commands and comments, or the data, from the last time you used DeTerminal. The former saves re-typing, and the latter can be a lifesaver in some circumstances!

The Bottom Line

RECOMMENDATION If hard disk space is at a premium, we recommend you turn the **return data** switch off (send **/r**) prior to logging. This avoids filling megabytes of your hard disk with data that you're logging in the Datataker anyway. If you don't turn the switch off, you end up with a copy of the already-logged data on your hard disk when you exit DeTerminal.

RECOMMENDATION But if you do have the hard disk space available, we recommend you leave the **return data** switch on during logging so that the $SESSION.DAT file contains all the session's data and can therefore be useful as a backup if the unthinkable happens.

Important

You must exit DeTerminal *correctly* for the new $SESSION.DAT and $SESSION.COM files to be automatically created — press the **Esc** key, highlight **EXIT DeTerminal now**, then press the **Enter** key.

In fact, this is important for *any* software application and the document(s) you create with it — turning the computer's power switch off when an application is running may cause corruption or "lost allocation units" (unusable space) to be created on the hard disk.

6-2 Start Logging (LOGON)

Here it is… *logging*.

Issue the **LOGON** command to the Datataker:

a) Type

```
LOGON
```

(all upper-case characters, no spaces). Be sure the **O**'s are letters and not the number zero.

b) Send the line (**Alt L**).

CONGRATULATIONS! The Datataker is now logging data to its internal memory.

c) Send

```
STATUS5
```

and confirm that the message **Logging is ON** is returned to the upper window.
Or, if your Datataker has an inbuilt display, you can simply scroll the display to see the message (without having to issue the **STATUS5** command).

Turn the variable resistance's knob to add some variety to the readings.

Datataker Memory Use

The Datataker has two places to which it can store data: its internal memory and, depending on the Datataker model, removable memory cards.

- With no memory card present, data is stored in the Datataker's internal memory.
- If you insert an *empty* memory card, the Datataker automatically transfers the data from its internal memory to the card, and continues logging to the card.
- If you remove a card during logging, the Datataker automatically continues logging to its internal memory.
- If you insert a card containing data, the Datataker does *not* transfer data to the card — logging continues to internal memory.
- If you clear the card (done by sending the **CDATA** command), the Datataker automatically transfers data from its internal memory to the card as if you had inserted an empty card.

- **"Stop When Full" Mode**
  In this mode, the Datataker fills any memory card present, then fills its internal memory and stops logging. Therefore, data acquired after all memory fills is discarded.
  This is the Datataker's default mode.
- **"Overwrite" Mode**
  In this mode (set by sending the **I/O** switch), new data *replaces* the oldest data once memory fills.
  Note that when in overwrite mode with a memory card inserted, the Datataker does *not* overflow data from a full card to its internal memory — in fact, in this mode, internal memory is *never* used if a memory card is present.
  If you remove the card, data is (over-)written to internal memory.

6-3 Stop Logging (LOGOFF)

Your Datataker keeps logging (and filling memory) until you command it to stop.

Let the Datataker log for a minute or two, then issue the **LOGOFF** command:

a) Wait two or three minutes for the Datataker to log a few hundred readings.

b) Send

```
LOGOFF
```

Remember that although you've stopped logging, the schedule is still running — the Datataker is still making measurements according to the schedule you sent at the beginning of this chapter.

6-4 Unload the Datataker (U)

Now transfer the data from the logger to the computer.

Note that after this transfer, the original data is still retained in the Datataker — only a *copy* of the data is transferred to the computer (see "Where is the Data?" in the Extras below). Also, the Datataker continues to log unerringly while data is being unloaded from it.

As before, data is transferred back to DeTerminal's upper window, the **From Datataker** window. So firstly clear the upper window ready for the new data.

Clear DeTerminal's upper window:

a) Press the **Tab** key once.
This toggles control to the upper window (makes it active instead of the lower window).

b) Hold down the **Alt** key, then press the **C** key. You'll see that this key combination completely clears the upper window.

Unload the logged data:

a) Press the **TAB** key once to make the lower window active.

b) Send the line

```
U
```

(just one character — an upper-case **U**).

c) The logged data flashes before your eyes in the upper window and stops when it has all been unloaded.

Scroll, print or save the unloaded data:

a) Press the **TAB** key once to make the upper window active.

b) Use the ⬆ and ⬇ arrow keys, and the **Page Up** and **Page Down** (or **Pg Up** and **Pg Dn**) keys, to scroll through the data.

c) If you wish, you can print all the data in the upper window (**Alt P**), or save it to a file (**Alt S**).

Where is the Data?

After you unload the Datataker, the data exists in two places:

- in the Datataker's memory (only a *copy* of the data is transferred to the computer, leaving the original data still in the Datataker), and
- in DeTerminal's upper window (the temporary "receive buffer" space on the computer's hard disk, to be precise — see the Extras "$SESSION Files" earlier in this chapter).

This means you can unload the same data as many times as you wish, and you can format the data differently each time.

Unload and Format

If you unload the Datataker by pressing the key combination **Alt U** (instead of sending the **U** command), you'll be presented with a dialog box in which you can choose from a variety of source, format and destination options for the data you're about to unload.

6-5 Enter a New Schedule After Logging

The Datataker protects its data. If you try to enter a new schedule immediately after logging, the Datataker returns a message reminding you that its memory still contains the logged data and that you have to consciously erase it before you can enter a new schedule.

Attempt to enter a schedule:

a) Send

```
RA1S 1TK
```

b) The Datataker responds with

```
E4-clear data memory
```

and ignores the new schedule.

Since you've already unloaded your logged data, it's safe to erase it from the logger's memory so that you *can* enter a new schedule.

CLEAR the logger's memory:

a) Send the line

```
CLEAR
```

You will now be permitted to enter a new schedule.

Remember that the previous schedule is still running. You can choose to…

- halt it (send **H** to halt all schedules, or **HA** to halt only the **A** schedule);
- replace it (send a new schedule);
- reschedule it (send a new schedule header);
- erase *all* schedules (send **CSCANS**, the **clear scans** command.)

6-6 Command Files

So far you've sent commands to the Datataker one line at a time.

Normally, you'll probably only do this if you're experimenting with the Datataker or with new sensors, or when you're testing and de-bugging commands.

But for an actual data acquisition and logging session, you'll usually have more than one line to send to the Datataker. Typically, you'll have some or all of the following:

- commands
  - RESET, LOGON, LOGOFF, Halt, Go,…
  - parameters
  - switches
  - date, time commands
  - schedule commands
- comments.

You put these commands and comments together into what's known as a "command file", and you send the entire command file to the Datataker with one action.

Later, if you need to alter something, we recommend you make the change(s) to your command file in DeTerminal's lower window and re-send the *entire* file.

RECOMMENDATION This way, you're always certain of your Datataker's configuration, especially if you make the **RESET** command the first line of your command file, followed by any special parameter and switch commands.

And, just like any other computer file, you can save command files to disk, then retrieve and re-use them in the future.

Before you send your first command file to the Datataker, here are some guidelines (and rules) for laying them out and sending them, some of which you've used already:

6-6.1 Guidelines and Rules

Treat Schedule Commands as a Group (BEGIN... END)

As stated above, we recommend you keep and send all your commands and comments together, as a group — a command file. This is a guideline to ensure the initial configuration of the Datataker and the reliability of your data acquisition and logging.

But — and this is the important statement — *the **schedule command(s)** within your command file must **always** be sent as a group.* (Note that we're talking about just the schedule command(s) here, not the entire command file.)

This is not a recommendation — it's a vital rule for sending *schedule commands* to the Datataker. Whether you use one, two, or all of the schedule commands, and whether or not you collect all you commands and comments together in a command file, ***schedule commands** must be sent — and re-sent — to the Datataker as a group (that is, all together, at once, all at the one time).*

This means that if you change, say, a channel ID of *any one* of your schedule commands, you must send all the schedule commands again — not just the one you've changed. Put another way, you cannot append channels to a schedule command or otherwise alter a schedule command once it has been sent. Instead, you make the changes and then re-send the *full set* of schedule commands.

To accomplish this — if all of your schedule commands don't fit on one line (maximum 250 characters, including spaces), or you want to put each command or channel on a separate line to enhance readability — you place them between the keywords **BEGIN** and **END** and send the whole block (including the two keywords).

Here's an example:

```
BEGIN
   RA1D D 'Date stamp
   RB1H T 'Time stamp
   RC2M
        1TT("Surface Temp 1")
        2TT("Surface Temp 2")
        3TT("Soil Temp 1cm")
        4TT("Soil Temp 5cm")
        5TT("Soil Temp 10cm")
END
```

Notice in the example that…

- you can also list a schedule's channel IDs vertically, as in the case of schedule **C** above;
- indenting lines (use spaces) gives your program logical structure and makes it very easy to read and modify.

You can also include blank lines to improve the layout.

Actually, most Datataker users prefer this vertical format.

How BEGIN... END Works

When the Datataker receives the **BEGIN** command, all existing schedules (including the alarm schedule, if you're using it) are halted, and all schedules (except the alarm schedule) are deleted. Then the Datataker receives and loads the new block of schedules into its channel table. Finally, on receipt of the **END** command, the Datataker restores the original halt/go status of each schedule and continues with any program lines that follow.

Rules for Commands

- Each line you send can not contain more than 250 characters (including spaces).
- Each command must be separated by…
  - at least one space, or
  - at least one carriage return — that is, on a new line. (When DeTerminal's lower window is in **Command Edit** mode, pressing the **Enter** key gives a carriage return. When DeTerminal's lower window is in **To Datataker** mode, pressing the key combination **Shift Enter** gives a carriage return.)

Rules for Schedules

- Each line you send can not contain more than 250 characters (including spaces).
- *All* of your schedule commands must be sent at one time. To accomplish this, you must type them all on one line, or place all of them between the **BEGIN** and **END** keywords as explained above. So if you want to change the channel IDs of, say, just one of your schedules, you must send *all* of the schedule commands again (as a group) after you've made the change — not just the one you altered.
- The Datataker will only accept a new schedule when it's *not* logging (issue the **LOGOFF** command) *AND* it contains no stored data (clear the data area — see "Memory Areas" and "Summary: Clear Commands" in the Extras below).

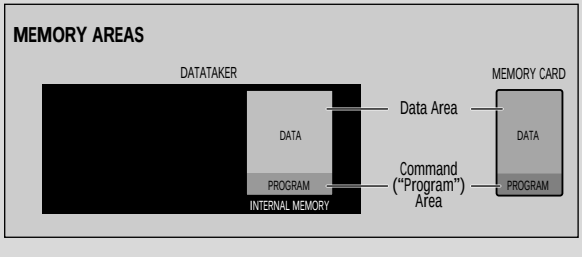
Datataker Program

Many users refer to the commands or the command file sent to the logger as a Datataker "program". We'll use this terminology in the following two Extras.

Memory Areas

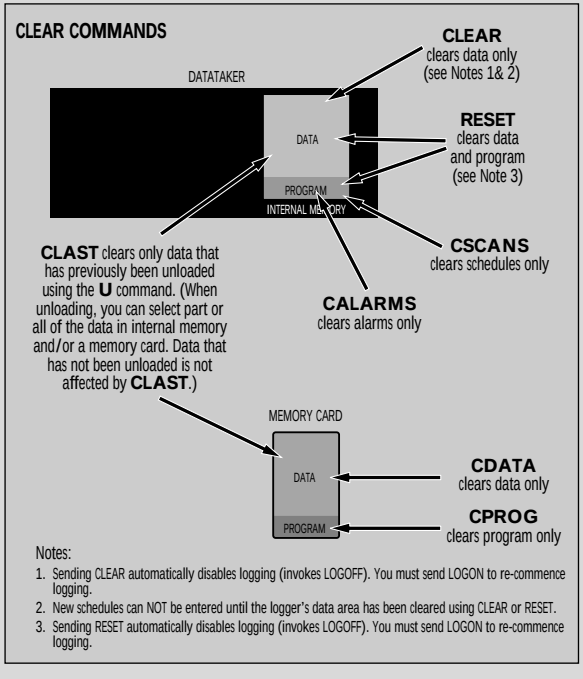
Your Datataker's internal memory is divided into two areas — one for storing data (the "data area"), and another for storing the commands you send (the "program area").

Similarly, memory cards contain a data area and a program area.



Summary: Clear Commands

You clear the various memory areas, and clear schedules and alarms, using the following commands:


CLEAR COMMANDS
CLEAR
clears data only
(see Notes 1& 2)
DATATAKER
DATA
PROGRAM
INTERNAL MEMORY
RESET
clears data and program
(see Note 3)
CLAST clears only data that has previously been unloaded using the U command. (When unloading, you can select part or all of the data in internal memory and/or a memory card. Data that has not been unloaded is not affected by CLAST.)
CSCANS
clears schedules only
CALARMS
clears alarms only
MEMORY CARD
DATA
PROGRAM
CDATA
clears data only
CPROG
clears program only
Notes:
1. Sending CLEAR automatically disables logging (invokes LOGOFF). You must send LOGON to re-commence logging.
2. New schedules can NOT be entered until the logger's data area has been cleared using CLEAR or RESET.
3. Sending RESET automatically disables logging (invokes LOGOFF). You must send LOGON to re-commence logging.

6-6.2 Three Little Schedules

Here you see how a new repeat schedule command automatically replaces any existing ones, and you use **BEGIN** and **END** to make the Datataker run three schedules at the same time.

RESET your Datataker, clear DeTerminal's lower window, then send the schedules below (one-at-a-time first, then all at once):

a) Type

```
RESET
```

and send the line (**ALT L**).

b) Hold down the **Alt** key then momentarily press the **C** key.
This key combination clears DeTerminal's lower window.

c) Type

```
BEGIN
     RA1S T
     RB5S 1TK
     RC10S 2R(4W)
END
```

Use the **Enter** key to move to the next line (when DeTerminal's lower window is in **Command Edit** mode), and use spaces to indent the three schedules.

d) Use the ⬆ and ⬇ arrow keys to select *only* the **A** schedule you just typed. Send just this one line (**Alt L**).
The time is returned to DeTerminal's window every second.

e) Now select the **B** schedule command, then send this one line only (**Alt L**).
The temperature as measured by the thermocouple on channel 1 is returned to DeTerminal's window every five seconds. Note that this is *all* that is returned — the **B** schedule has replaced the **A** schedule that was previously running.

f) Select the **C** schedule command. Send this one line only (**Alt L**).
The reading from the variable resistance on channel 2 is returned to DeTerminal's window every ten seconds. Note that this is *all* that is returned — the **C** schedule has replaced the **B** schedule.

g) Finally, use the key combination **Alt A** to send the three schedule commands together. (**Alt A** sends everything in the lower window — in this case, the **BEGIN** command, the schedule commands, then the **END** command.)
Because you sent them together, your Datataker is now running all three schedules (as you can verify in DeTerminal's upper window).

So you can see that using the **BEGIN** and **END** commands (or putting all your schedules on the one line) is the way to get the Datataker to run more than one schedule at a time.

If you want, you can now save your "program" (everything in the lower window) — use **Alt S**.

6-6.3 Send One, Send All

Now let's say you want to make a change to one of the schedule commands while keeping the others as they are.

Change one of the schedules, and re-send:

a) Change schedule command **C** so that it adds the date once every second by editing the **RC** line to read

```
RC1S 2R(4W) D
```

b) For this to take effect *and to keep the others running*, you must re-send *all* your schedule commands, so do this now using the **Alt A** key combination.

The new schedules replace the existing ones — the net effect in this case is to add the date beside each variable resistance reading.

The point is that if you were to send *only* the new **C** schedule command, it would replace *all* the existing schedules and therefore become the only one running. ***Send one, send all.***

We're using schedule repeat times (triggers) of only a few seconds in the examples in this guide so that you can see the various operations occurring straight-away. In practice, you can use schedule repeat times as short as one second or as long as thousands of days.

6-6.4 Create and Send a Command File

Now you create a typical command file by adding other commands (like parameters and switches) and comments to a group of schedules.

Clear DeTerminal's lower window, then send the command file below:

a) Clear the lower window (**Alt C**).

b) Type

```
'Cabbage Patch Expt.

CPROG
RESET
\W3
CDATA
T=\T
D=\D
$="^G REMINDER: Feed cabbages"
/n/u  'Ch. no. & units off
P22=44

BEGIN
  RA1D D   'Daily date stamp
  RB1H T   'Hourly time stamp
  RC1S 1TK 2R(4W)
  RD5S $
END

LOGON
G
```

c) Send this command file to the Datataker. Be sure to use the **Alt A** key combination so that you send *everything* in the lower window.

In the command file above…

- Text following an apostrophe (foot mark) is a comment only — it's sent to the Datataker and echoed back to DeTerminal's upper window, but is otherwise ignored by the Datataker.
- **CPROG** clears all commands from an inserted memory card — this line is a precaution to stop any command(s) in an inserted memory card being run (as will happen if the card is removed and then re-inserted — see the Extras "Caution — Memory Cards").
- **RESET** clears the Datataker's internal memory of all data, commands, and time and date settings (as well as halting all schedules and returning all switches and parameters to their default values).
- **\W3** causes DeTerminal to wait for 3 seconds before sending the next line . It's an extremely important step because without it the following few lines would be lost by the Datataker while it resets.

RECOMMENDATION ***You should make it standard practice to include this wait command after each RESET you send.***

- **CDATA** clears all data from an inserted memory card.
- The commands **T=\T** and **D=\D** cause DeTerminal to set the Datataker's time and date to your computer's time and date (they were previously reset to 00:00:00 on 1/1/89 by the **RESET** command).
- The **$="^G…** line assigns a computer beep (**^G**) and a message to the Datataker's text channel. This will be used by the **D** schedule.
- Switches **/n** and **/u** turn off the display of channel number and units, respectively, and setting parameter **P22** to 44 sets the data separator to ASCII character 44, the comma — these two lines configure the data ready for importing into a spreadsheet (rows of comma-separated values).
- The **A** schedule reads the date once a day. This will only happen at the beginning of each new day because the Datataker is synchronised to midnight (the **/S** switch is enabled).
- The **B** schedule reads the time every hour. This will only happen at the beginning of each hour because the Datataker is synchronised to midnight (the **/S** switch is enabled).
- The **C** schedule reads the thermocouple (channel 1) and the variable resistance (channel 2) every one second.
- The **D** schedule scans the Datataker's text channel every five seconds. Because you assigned a beep (**^G**) and a message to the text channel (8th line of the command file), your computer beeps and displays the message every five seconds.
- The **LOGON** command enables logging.
- **G** (Go schedules) starts all schedules (they were previously halted by the **RESET** command).

Readability

RECOMMENDATION Again we recommend that you make your command files logical and readable by laying them out as in the example above. The section "Writing Datataker Programs" in the "Reference Manual for the Datataker Data Loggers" (available from your Datataker dealer) discusses this topic in detail.

Caution – Memory Cards

Whenever you insert a memory card into your Datataker's memory card socket and the Datataker is *NOT* logging, any command (a schedule command; a parameter, switch, date or time setting; RESET, Halt, Go, and so on) or command file present on the card will automatically run — immediately.

Yes, this means that every time you plug a memory card containing a schedule into your Datataker which is not yet logging, the schedule is processed and run straight away, thereby *replacing any schedules the Datataker is currently running*.

Take care with this feature — avoid *unintentionally* sending new schedules or settings to your Datataker in this way.

Stand-Alone Operation

If you want, you can disconnect the computer (unplug the comms cable from the Datataker) and the logger will continue operating according to the command file you just sent.

You can also disconnect the mains adaptor and the logger will run from its battery (if connected and charged), completely stand-alone.

NOTE

Actually, there's a more memory-efficient way of adding a time stamp and a date stamp to your logged data than including **T** and **D** (as in schedules **A** and **B** above) — and you've already used it. One of the Datataker's basic housekeeping functions is to begin each schedule's logging with a record from which it can always obtain the time and date of every reading.

So — instead of including **T** in a schedule command, which causes an *additional channel* to be read and logged (the Datataker's internal "time channel") — simply turn on the **prefix data with time** switch (**/T**) as you did in "Add a Time Prefix" earlier in this guide. Then the time is *not logged* (saving Datataker memory space), but *is* finally included with each reading when you unload the data.

Similarly, send **/D** to enable the **prefix data with date** switch.

Data Protection

You'll often want to send new or modified schedule commands to your Datataker, particularly when setting up a logging session. To make this quick and easy, the logger is designed so that any *repeat* schedule command you send automatically deletes and replaces *all* previous schedules. (There's one exception: the alarm schedule, if you're using it, is *NOT* automatically deleted by sending new repeat schedules.)

This is subject to two conditions: it only happens…

- if the Datataker is NOT logging, and
- if its memory contains NO data.

This is because your Datataker's first priority is to protects its data.

So if it's logging or its memory contains any data, new repeat schedules are ignored. But if your logger is running one or more repeat schedules — but not logging, and its memory has been cleared — and you send a repeat schedule **RD**, all of the existing schedules (except the alarm schedule) will be deleted upon receipt of **RD** leaving only **RD** running.

Of course, *immediate* schedule commands don't replace your current schedules, and you can send an immediate schedule command at any time — even when the Datataker is logging.

6-6.5 Example Command File

The DeTerminal disk supplied with your new Datataker contains an example command file. It incorporates some of what you've done so far, as well as introducing a few new commands.

Although each line of the file has a comment to explain its purpose, you might like to refer to your "Datataker Manual" for a detailed explanation.

Clear DeTerminal's lower window, then open the **EXAMPLE.CMD** file supplied (it's in the **determ** directory on your hard disk):

a) Press **Alt C** to clear DeTerminal's lower window, then use **Alt O** to go to the **Open** dialog box.

b) Use the ⬇ key to highlight **EXAMPLE**.

c) Press the **Enter** key.

d) Press the **Enter** key again.
The Example file is loaded into DeTerminal's lower window.

e) Read through the file. It will reinforce what you already know, and introduce some new material. You can use the ⬆ and ⬇ arrow keys to scroll through it or, if the computer is connected to a printer, print the file — **Alt P**.

f) Send the file to your Datataker (**Alt A**).

6-7 Exit DeTerminal

You've nearly finished. All that remains is to leave the Datataker in a suitable state and exit (quit) DeTerminal.

Your Datataker doesn't have a power on/off switch, so the moment you provide power to it, it comes alive. Even without you sending schedules and commands, it's constantly repeating its own internal housekeeping operations of monitoring and calibrating itself. Over a long period of time these operations can fully discharge any battery — internal or external — connected to the Datataker.

Keeping the logger powered from its mains adaptor is one way of ensuring the battery stays charged. Otherwise…

- when not using your Datataker for *short* periods of time (days, a few weeks), either halting all schedules (send **H**) or clearing all schedules (send **CSCANS** and **CALARMS**, or simply **RESET** the Datataker) will minimise battery consumption;
- when not using your Datataker for *long* periods of time (months), disconnect all batteries — don't forget the internal one — so they can't be fully drained by the logger.

Halt or clear the schedules your Datataker is currently running:

a) Send **H** to halt all schedules (this does not erase the schedules from the Datataker — you can start them again by sending **G**, "Go all schedules"), or send **CSCANS** to halt all schedules *and clear them* from the Datataker.

Exit DeTerminal:

a) Press the escape key (**Esc**).
You are offered two options:

```
Continue DeTerminal
EXIT DeTerminal now
```

b) Press the ⬇ key once to select (highlight) the lower option.

c) Press the **Enter** key to accept the selected option.
DeTerminal closes and returns you to DOS.

DeTerminal Preferences

Each time you start DeTerminal, it remembers how you had it set up last and launches immediately in that configuration. For example, it remembers the screen colour combination you chose using **F2**, the relative sizes of the upper and lower windows (**F3**, **F4**), the mode of the lower window (**Command Edit** or **To Datataker**), and a dozen other details. These are your "preferences" for using the program.

So the next time you start DeTerminal, it may not be configured in exactly the same way as when you first started it earlier in this User's Guide.

If you wish, you can easily reset these preferences to their default values by deleting the DeTerminal configuration file **DT.CFG**. Do this in DOS, by going to your **determ** directory and typing

```
del dt.cfg↵
```

(↵ is the symbol for your keyboard's **Enter** key). A new **DT.CFG** file will be created automatically in your **determ** directory the next time you start DeTerminal.

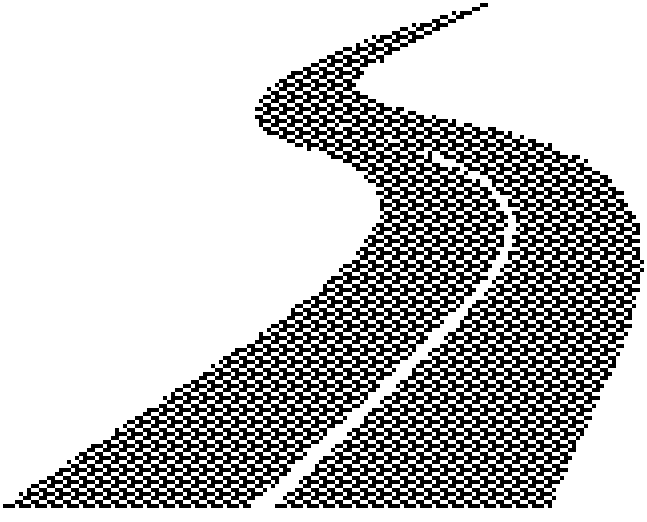
It's Just the Beginning

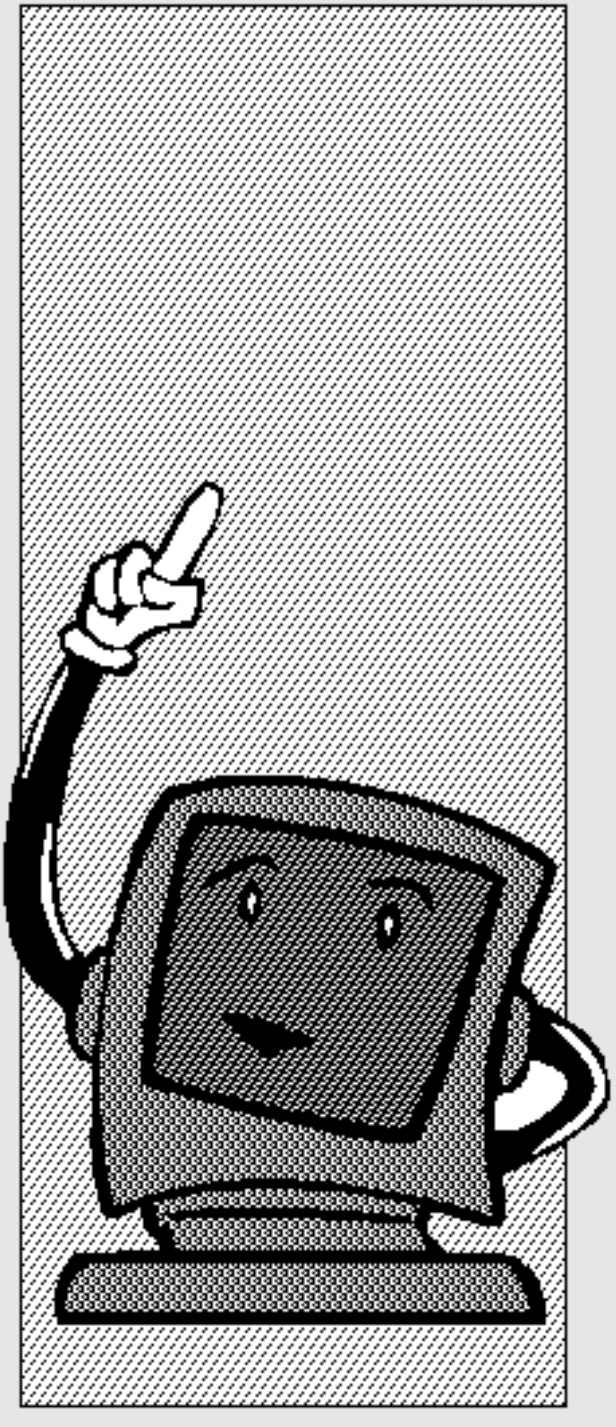
Now that you've finished working through this guide, you'll have seen how easy Datataker is to use and you have enough knowledge to set up your own basic data acquisition and logging sessions.

But we've only introduced you to a small fraction of your Datataker's capabilities. So, armed with these fundamentals and your "Datataker Manual", we suggest that you investigate the following topics:

- sensor types;
- input configurations;
- statistical sub-schedules;
- alarms (for example, to start and stop logging);
- scaling data and doing calculations within the Datataker;
- adding a memory card (to store extra data, or as a vehicle to transfer your program from the computer to the Datataker);
- connecting two or more Datatakers together to form a network;
- possible causes of problems and errors, and hints for successful acquisition and logging (ground loops, noise, shielding, sensor self-heating, sensor selection, scanning frequency, reducing the volume of data, method of data recovery and archiving,…);
- backup batteries, battery life;
- inbuilt display panel operation (if your Datataker has one);
- counters.

All these are covered in both the concise "Datataker Manual" (supplied with your Datataker), and the "Reference Manual for the Datataker Data Loggers" (available separately).





Appendix One

For Experts Only

If you're experienced with data acquisition and logging — and IBM or compatible computers — this section (and the **HELP** file: press **F1**) may be all you need to get up-and-running with Datataker.

1
Make a Backup and Install the Software
Make a backup copy of the DeTerminal disk and copy all the DeTerminal files to a directory on your hard disk.

2
Connect Power and the Computer
Connect the mains adaptor to your Datataker's **AC/DC** terminals (polarity is not important). Turn the power on at the wall.

Connect the Datataker to your computer's **COM1** or **COM2** port using the cable supplied.

3
Run DeTerminal
Enter **DT** if the Datataker is connected to **COM1**, or **DT COM2** if it's connected to **COM2**.

4
DeTerminal's Windows
DeTerminal is a smart terminal package. The lower part of the screen is a scrollable text editing window where a Datataker command file ("program") can be developed. This is the **Command Edit** window. Individual command lines can be sent to the Datataker using the **Alt L** key combination, or the entire command file can be sent using **Alt A**.

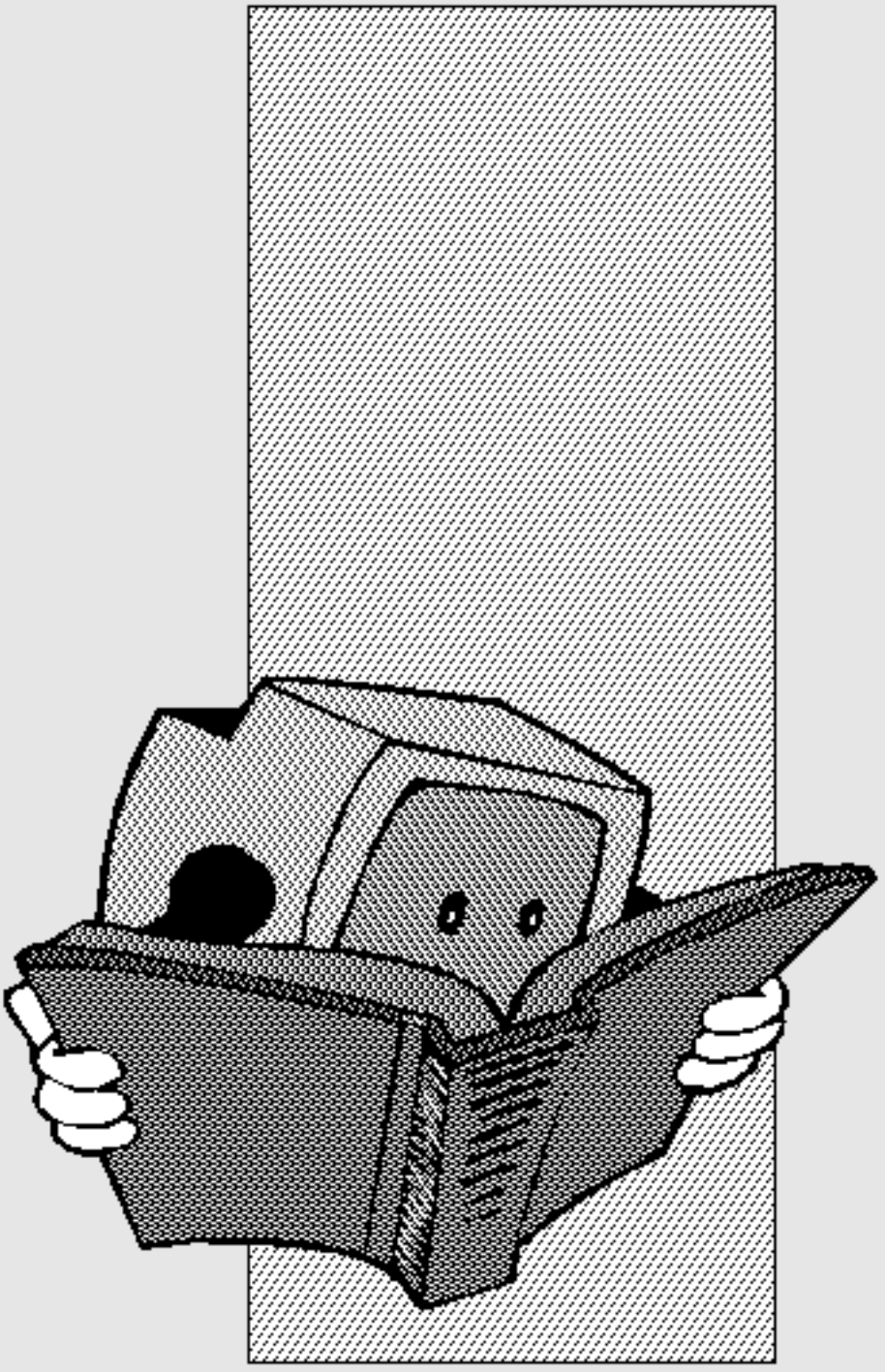
When commands are sent to the Datataker they are normally echoed back to the upper window along with any Datataker responses. This is the **From Datataker** window and it's also scrollable.

Keyboard control is toggled between the two windows using the **Tab** key. Both windows can be saved, printed and cleared. The **F1** key accesses on-line help.

5
Your First Datataker Commands
Type **T** and send the line (**Alt L**). The Datataker responds with the time since power-up.

Now measure temperature. Connect the thermocouple supplied to channel 5 (see "Add a Sensor" earlier in this User's Guide for connection details). Send the line **RA2S 5TK**. This instructs the Datataker to scan channel 5 every two seconds and read it as a K-type thermocouple.

6
Now What?
Use the "Datataker Manual" supplied with each new Datataker to become familiar with topics that are of interest to you.



Appendix Two

Basic DeTerminal Keystrokes

Esc Continue or exit DeTerminal; close dialog box

F Keys

F1 Help

F2 Cycle through the colour palettes

F3 Increase the size of the lower window by one line

Shift F3 Increase the size of the lower window to maximum

F4 Increase the size of the upper window by one line

Shift F4 Increase the size of the upper window to maximum

F5 Undo editing changes in the current line (lower window)

F6 Copy the current line into the scrap buffer

F7 Cut (erase) the current line into the scrap buffer

F8 Paste the line from the scrap buffer into the current line

F9 Shell to DOS temporarily

F10 Trigger the alarm schedule

Alt F Key Combinations

Alt F1 Debug Mode on/off

Alt F2 Wake Mode on/off

Alt F3 Comms Mode on/off

Alt F4 Delete any file

Alt F7 Perform an automatic baud rate search with a Datataker

Alt F8 Force upper or lower case on the current line

Alt F9 Reset communications

Alt F10 Toggle lower window between **To Datataker** and **Command Edit** modes

Alt... Key Combinations

Alt A Send all information in the lower window to the Datataker

Alt B Execute a block from the user's selected list of execution labels

Alt C Clear the upper (receive) or lower (transmit) buffer

Alt D Delete the highlighted line

Alt E Delete to the end of the highlighted line

Alt F File capture on/off

Alt L Send the highlighted line to the Datataker

Alt O Open and load the selected file into the lower window

Alt P Print contents of the lower window (**To Datataker** or **Command Edit** buffers)

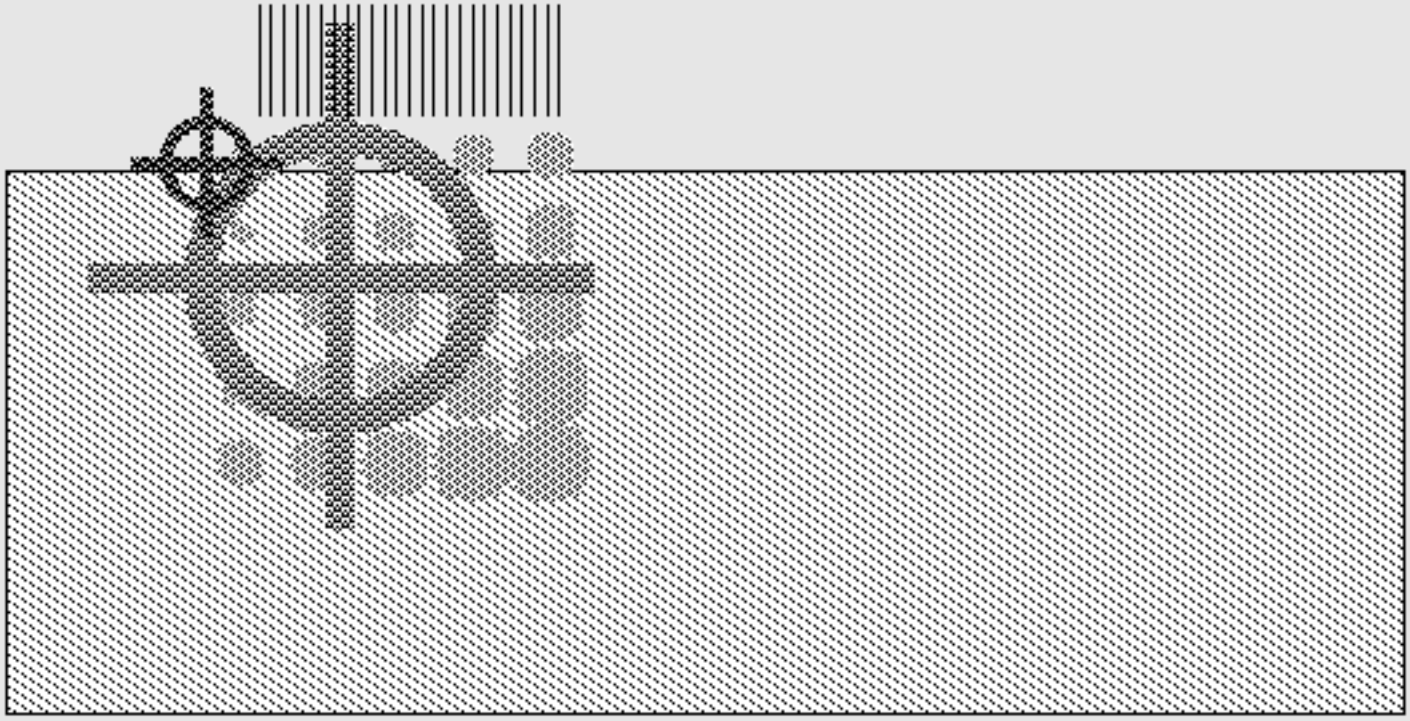
Alt S Save contents of the lower window (**To Datataker** or **Command Edit** buffers)

Alt T Transfer data from the upper window into the lower window

Alt U Unload data from the Datataker into the upper window (receive buffer) — source, format and destination options

Alt Z Send a break to the Datataker

For a complete key summary and a description of all the DeTerminal commands, see the "DeTerminal User's Manual" (available from Data Electronics) or DeTerminal's HELP file.



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/S, **/s** (**synchronise** switch), *see* commands

/T, **/t** (**prefix data with time** switch), *see* commands

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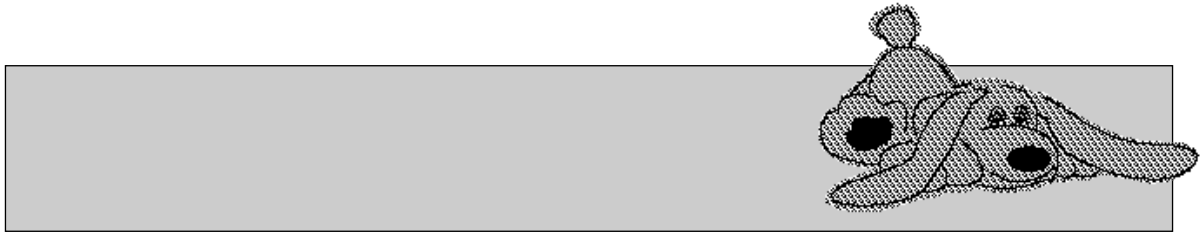

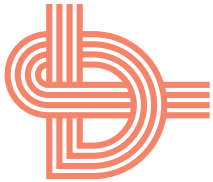

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